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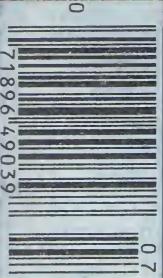
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ON THE COVER: This tableau featuring a close encounter between NASA, Hollywood and an alien intelligence was designed and photographed by Michael Sullivan. See *Seeking Extraterrestrial Life*, beginning page 24 and "Alien" Arrives beginning page 27.

ON THE CONTENTS PAGE: Chris Foss' cover painting for Isaac Asimov's book "The Stars in Their Courses." British science fiction artist Foss is interviewed in this issue's Portfolio, beginning page 58.

output

The crisis at Three Mile Island power plant has set everyone thinking about the future of nuclear power. What took place at that facility was actually less important than what *will* take place as a result. Since it is the focus of this magazine to help aim the human race toward an improved future life, I want to address the issues involved in some detail.

Early morning Wednesday, March 28th, the nuclear reactor located near Harrisburg, Pennsylvania, suffered a series of systems failures. These triggered a dangerous overheating in the reactor core, formation of a volatile hydrogen bubble, and uncontrolled venting of steam and spillage of water—both radiation-laden. At first, local engineers and Nuclear Regulatory Commission officials could not determine the precise extent of the damages nor the actual dangers. Within 48 hours the governor cautiously advised pregnant mothers and preschool children (those most susceptible to the least amount of radiation) to evacuate the immediate area.

When asked if the situation was completely under control, Metropolitan Edison spokesmen said, in essence, "we're doing our best." When asked if a complete meltdown, like the one dramatized in the current film *The China Syndrome* (see FUTURE LIFE #10, pg. 20) was possible, they said, "the possibility exists."

This was sufficient to unleash *New York Post* headlines: "RACE WITH NUCLEAR DISASTER... Harrisburg on edge of a nightmare... Residents flee towns near site..." The nuclear news eclipsed the momentous Egypt/Israel peace treaty, and by Friday night the entire world was watching hour-by-hour coverage, waiting with bated breath to see if the catastrophes predicted by anti-nuke crusaders would come true.

Nuclear power critic Ralph Nader appeared frequently on television interviews declaring without qualification, "This is the beginning of the end of nuclear power in this country." Even pro-nuke supporters admitted that the incident would probably mean a temporary halt in construction of nuclear power plants. President Carter stated that the incident "will make all of us reassess our present safety regulations... and will probably lead inexorably toward even more stringent safety-design mechanisms and standards."

By the following Wednesday the crisis had receded, and while the nation's press returned to stories of rape and murder, the engineers at Three Mile Island continued the laborious process of deciphering information and carefully cleaning up the damages.

Throughout the week-long ordeal, radio/TV announcers and newspaper and magazine reporters, to my knowledge, never mentioned a single word of admiration for the engineers and workers who had risked the most—standing at their jobs in order to do whatever was needed to prevent harm to the public at large. Presumably these workers were part of the deadly project and therefore worthy only of scorn.

I say, on behalf of everyone who *might* have been killed or permanently harmed by a radiation catastrophe—but was *not*—a strong, heartfelt expression of gratitude is due to those who worked around the clock to solve the mysteries that boiled inside those concrete walls. The skills and expertise of those workers are a tribute to dedication and courage and attest to the fact that, even facing the worst nuclear accident in history, human knowledge can prevail.

But what of the human errors, in designs and decisions, that created the crisis in the first place? It is equally important to recognize these. After all, the public had been told that safety mechanisms were sufficiently backed up to make an incident of this sort next to impossible. And those assurances had been as soothingly stated as announcements made early after the first alarms went off Wednesday, "The reactor... should be cooled by the end of the day."

Entreaties not to worry are more alarming than spelling out the dangers in graphic terms, because just as soon as any inaccuracy or contradiction is detected, deceit is suspected. That is what happened in Pennsylvania.

A plant spokesman said one thing, an NRC official said something different, the governor had yet another version, and the people grew terrified—not because they feared the situation, but because they feared the worst. "We don't know what to think

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about the situation here anymore," said one man hastily loading his station wagon for evacuation. "We have been given so much false information by Metropolitan Edison."

In fact, I seriously doubt that there was *intentional* deceit. The problem was that for more than two days no one really understood the facts of the situation. Nobody knew what might happen next—things might be quickly stabilized or a sudden explosion might crack the encasement walls and send radioactive steam into the air, flying wherever the wind would take it. Nobody knew.

Nearby residents reacted according to individual natures: some wept before TV cameras and clutched babies protectively while others lettered wry signs like the one attached to a Harrisburg convertible, "JUST OUT ABSORBING SOME RADIATION." It was all good stuff for the six o'clock news.

In fact, the only people who had a field day out of the whole situation were the teams of quickly-imported reporters who squeezed every ounce of life-and-death drama out of the struggle for knowledge and control.

So, for one week the press created hysterics. *The China Syndrome* projected evil motivations on the part of nuclear plant officials. Nader made brash pronouncements. Demonstrators paraded. And spokesmen from NRC and Met Ed reassured with smooth half-truths. The overall result was a frightened public, turned quickly sour on nuclear power. All this is to be expected in the sudden throes of an emergency, but now that the danger has subsided, we need none of these approaches to the question of nuclear power. We need reason.

* * *

Everyone acknowledges that the U.S. needs abundant, economical power sources. Nuclear reactors are a solution, and the legitimate objections boil down to two problems: safety and waste disposal. Neither of these two problems is adequately solved at present, since even a 99 percent solution is not satisfactory. The enormous dangers inherent require 100 percent solutions.

The technological details of the nuclear power debate are highly complex, but the fundamental question is simple: There are those who believe that the human mind is ultimately capable of *absolute control over all the powers of nature*, and there are those who do not believe this. Now, if we *are* capable it follows that we ought to proceed with haste to actualize that control over nature's forces (just as we have done significantly with water and wind and gravity), but if we *are not* capable then we ought to halt immediately our futile, dangerous attempts.

This same question is at the root of all frontier exploration. Anti-nuke arguments are the atomic version of "man was not meant to fly" since flying makes crashing possible. If we stay on the ground no one will ever be killed in a plane crash! On that basis, of course, the human race should avoid *anything* that involves risk and dangers.

I have no doubt that human ingenuity *can*, in the long run, create *absolute* control of the power-generating process as well as the waste-disposal system. The real question is, will the cost of 100 percent solutions take nuclear power out of the "cheap" category?

It seems advisable at present to pursue development of *all* power sources: solar, tides, even garbage reprocessing—anything an energy company speculates will be profitable. There may be some yet-discovered natural force that can be harnessed and refined to solve all our energy problems, and it might be discovered by some genius with a kite and a key.

Until breakthroughs occur, there is no reason to let this particular accident bury nuclear power development. If the incident at Three Mile Island, in which almost everything that *could* go wrong *did* go wrong, still didn't result in a solitary case of radiation injury, it borders on fanatic irrationalism to use that accident as the *basis* for fighting to shut down the nuclear power industry.

If anything, the knowledge acquired from this incident can be put to good use; the unexpected elements can be analyzed and engineered *out of* future possibility. That's how the human race turns negatives into positives.

When I first started researching and writing this column, my emotional feeling toward nuclear power was, like many people, wary and negative. But the more I thought through the issues and considered that fundamental attitude toward exploration, the more my reason changed my emotions. A great deal can be learned from this accident—a great deal that will move us along the road toward the goal of absolute control and another triumph for the human race in our climb toward the future.

But if we react with blind, emotional fear and abandon all the knowledge of atomic control that we have gained thus far, retreating toward the safety of candlelight and mule power, that indeed will turn Three Mile Island into a tragedy of incredible magnitude.

Kerry O'Quinn/Publisher

Because of the large volume of mail we receive, personal replies are impossible. Comments, questions and suggestions are appreciated, however, and those of general interest may be selected for publication in future issues. Write:

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WANTED: CONTROVERSY

... Congratulations on your splendid magazine. If only it would come out more frequently... but that might affect its quality, so I'll just have to be patient.

I don't usually disagree with Harlan Ellison or Ursula LeGuin, but really, they protesteth too much about *Star Wars* and *CE3K*. I doubt if the greater majority of the viewing public sees the messages that they see in these films.

As to the letter on TV in FUTURE #8, John Carney seems to think TV can only be supported by advertising. Has he never heard of BBC? Paid for by license fees, a reasonable fee I might add! and still completely impartial. This service provides two TV channels and a news channel, plus national and regional radio services.

Your magazine proves its popularity with me by almost forcing me to reply to you. Please keep putting in controversial ideas which will at least make us jump out of our complacency.

Alan Stephen
Aberdeen, Scotland

RAY'S ROOTS

... Your article in FUTURE LIFE #9 on Ray Bradbury's *Martian Chronicles* needs one correction: Bradbury is a native Illinoisan, not an Ohioan.

Steven Dhuey
Madison, WI

SPACE ART SPLENDOR

... I have received the first and second selections of the Space Art Club. They're beautiful! More than I expected. I am thoroughly satisfied and hope you continue the club in coming years. Keep sending those gorgeous prints.

Eric E. White
Oshawa, Ont., Canada

SQUATTER'S RIGHTS

... Trying to describe your magazine is impossible. I can only say it's more than excellent. I love to live in "future life!"

Jurgen Reissing
Newmarket, Ont., Canada

FLIPPER: 1999

... Could you foresee our NASA space program sending dolphins into outer space, to test their brain patterns before sending an astronaut into that unexplored region? The dolphins would be sealed tight in water tanks with Earth ground

observers monitoring their brain functions.

Secondly, I would like to publicize the need for cultural exhibiting of science fiction museums to be constructed in Philadelphia, New York, Washington, D.C., and other major American cities. Can you imagine the sci-fi exhibitions, job expansion, publicity, talent, kiddie attendance, cultural status, tax raises for cities, etc.?

David Haig
Philadelphia, PA

Have you asked any dolphins whether they particularly want to be our predecessors into space? As for science fiction museums, a good sampling of attractions catering to science fiction fans will be found in our "Summertrek" article in this issue.

OUT OF LEFT FIELD



... OK! Ladies and gentlemen, enough is enough!

Ever since *Battlestar Galactica* came over the tube, I've sat back here and held my comments while the rest of science fiction fandom ribbed, ridiculed and called the show everything on the downhill side of crummy.

Come on, people! I'll grant you it's not *Star Trek*, but the show does have a fine group of actors and the plot isn't any worse than the "World War II/King Arthur" plot of *Star Wars*. It has some nice special effects in places, too.

So it's not the science fiction fantasy we were expecting, but it certainly beats the hell out of *Charlie's Angels*!

Julie Reames
South Bend, IN

FILE PHILE

... FUTURE LIFE is an excellent magazine, and I look forward to each new issue. And I wish to preserve them for future reference. But I have a problem. In FUTURE #8, Jorg Ronke wrote in asking for an address to purchase protective files. You indicated that there was an ad in that issue for it—well, maybe my eyesight is failing me, but I couldn't find that ad. Could you help me?

Janice M. Yates
Tuscon, AZ

Sorry about that—you can find out about protective files by writing to the Jesse Jones Box Corp., 2250 East Butler Street, Philadelphia, PA 19137.

FUTURE RENAISSANCE

... I am impressed by the new title and renewed attitudes of your magazine. May it go on forever.

I enjoyed the Harlan Ellison article. It showed a side of the man I never knew before. He seems to have a healthy attitude towards science fiction which will keep him going for his whole life.

"The Re-Making of Star Trek" was excellent. I can't wait to see this grand and glorious movie. It sounds like it will be a classic.

The Devo article was interesting.

The very best article in FUTURE LIFE #9 was the Tomorrow column with Jacques-Yves Cousteau. He has been my hero and idol for many years. Your article confirmed my belief in his work and life. He is very concerned about the world water problem. The time for action is now, while we still have beautiful oceans. Steps should be taken to prevent oil spills and pollution. If these problems are not solved, the oceans will die. If they die, we will die.

Thank you for a very important magazine.

Tim Knapp
Hudson, NY

PRO PLANETARIUMS

... Congratulations on an extremely informative and entertaining magazine. The layout, graphics and content are excellent.

I am prompted to write about the article about planetariums which occurred in FUTURE LIFE #9. It was accurate and well written. I do wish that you would provide a small biography about the author of any special articles, so that the reader can get some idea of his or her background and expertise in the subject matter. Mr. Harrison is obviously well informed and traveled; however, he did fail to mention a recent departure in planetarium design. The tilted dome—or "space theater"—concept takes planetarium/fish-eye motion picture theaters like the Flandrau Planetarium one step further in realism and audience involvement. By tilting the floor, the artificial horizon created by the edge of the dome is lowered from view, providing a more realistic backdrop for projections of both still and moving pictures of outer space or Earth-based scenes. By completely filling the spectator's field of vision, a motion picture or well-produced planetarium show can produce an awesome sense of realism.

Only three major planetariums are equipped to provide such a visual experience: the Reuben H. Fleet Space Theater in San Diego, California; the William L. McKnight-3M Omnitheater in Saint Paul, Minnesota; and the Alfa Cultural Center in Monterrey, Mexico. Each theater has the latest model planetarium produced by Spitz Space Systems—the "S.T.S." or "Space Transit Simulator"—and a unique motion picture system called "Omnimax" which is an expanded format 70mm film system manufactured by IMAX Systems Corp. of Toronto, Canada. (IMAX produced the system which has been in use at the National Air and Space Museum in Washington, D.C.) The "Sensorium" theater at the Detroit Science Center also has an Omnimax projection system without the S.T.S. planetarium projector, although it soon plans to obtain an S.T.S. to (continued on page 8)

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input

(continued from page 6)

complete its instrumentation for planetarium productions.

Since the films for the Omnimax system are so expensive to produce (costs range as high as \$10,000 per minute), few films of substantial length have been produced. The few films which have been done are breathtaking in their beauty and realism. Extensive use of location and aerial photography have been used for programs about Earth-based subjects. Innovative special effects photography has also been achieved on relatively modest budgets for simulation of space travel, formation of the Earth and other planets, and other concepts used to illustrate various topics.

Last summer, members of the four theaters mentioned above formed an association called the Space Theater Consortium, which will pool the resources of the member organizations in producing future films. The future of the organization is promising, although the construction of future space theaters is a painfully slow and expensive process. A completely equipped theater with a 75-foot diameter dome can cost between three and four million dollars.

Charles F. "Chip" Gronauer
Tequesta, FL

POINTS FOR PLANETARIUMS

... Your article "Theaters of Tomorrow" by Philip Harrison, which appeared in FUTURE LIFE #9, is the single best synopsis of the nature of planetaria. It is time planetaria are recognized as the "theaters of applied art."

Philip R. Groce
Alexander Brest Planetarium
Jacksonville, FL

MUTUAL MAYHEM

... If Mr. Gerrold accepts homosexuality (see FUTURE #6), does he also accept the futuristic sport described in the Robert Sheckley story "Tenth Victim?" In this story, you join a club so that you can confront an opponent against whom you might fight to the death. It's all done in the name of sports. Legalized murder as a sport.

The main point is that there's mutual consent between the two combatants, for which reason I would accept it. Even Bernard De Koven, games expert, advocates it in his book *The Well-Played Game*.

Remember, Mr. Gerrold, the sport has mutual consent.

Masao Kono
Honolulu, HI

SOUND IDEA

... I enjoyed FUTURE #8 very much, especially since you ran an article on my special interest: electronic music. I have loved the spacey sounds of synthesizers and such ever since I was very young and saw my first demonstration of a theramin.

Where can I obtain music from the persons or groups featured in your article "Futurerock?" I would especially like information concerning the German group Kraftwerk. Any information

would be gratefully appreciated—I am tired of the flood of disco music.

L. G. Canedy
Wareham, MA

Kraftwerk records for Capitol Records.

PENNIES FOR HEAVEN

... How would you like to make \$1.5 billion? My team and I would like to salvage the \$2.6 billion Skylab. I've been studying NASA's salvage program, and we know we can salvage Skylab before they will.

My team consists of the following: myself (a business machine repairer), Bob Truax (a retired NASA engineer who helped to design the Polaris missile, was the first director of the USAF space program, was named Engineer of the Year four years ago by the American Institute of Aeronautics and made his own rocket), two amateur pilots and an electrician.

We need someone willing to raise \$500,000 in sponsor money. We know this is a lot to ask, but that's the lowest possible cost. If you can raise the money (or you know someone who can raise the money), write and tell us. Write back even if there is no way of getting the money.

David W. Pettry
Brook Park, OH

BUCK = BATTLESTAR®

... After viewing the recent two hour special on *Battlestar Galactica* I noticed a striking similarity between the Terran Space Shuttle and the spacecraft pictured in your Buck Rogers article (FUTURE #7). Was this the same model modified slightly for use on *Galactica*?

Tom Monson
Deptford, NJ

Yes. True to the maxim of "waste not, want not," Universal used the same spacecraft for both features.

BEAUTIFUL ACCIDENT

... While reading FUTURE LIFE #9, I happened to notice a remarkable optical fancy. Take the right hand page of the centerfold and hold it up to a window or light. Out from behind Luke's blue Martian sky comes the image of Albert Einstein in all his glory.

Tell the truth now, did you plan it that way?
Joseph E. Scarfone
Toronto, Ont., Canada

MOONRAKER MUSIC

... I have read FUTURE LIFE #9 on the new James Bond movie *Moonraker*. I would like to know whether or not John Barry will be doing the musical score for the film.

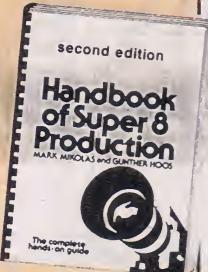
Vernon A. Davis
Pittsburgh, PA

Rest assured, when Bond comes back this summer, Barry will be in tow.

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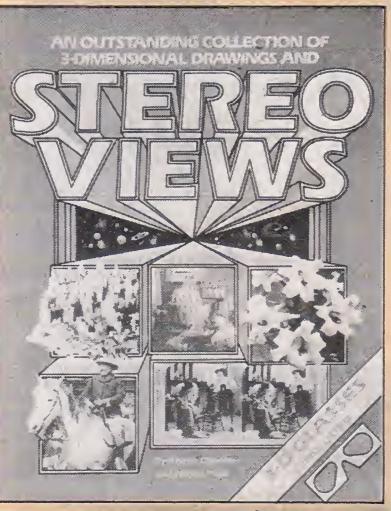
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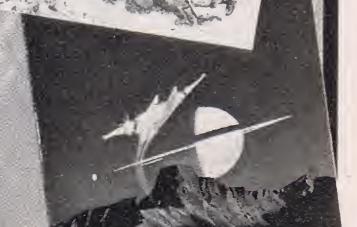
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TROUBLE IN PARADISE

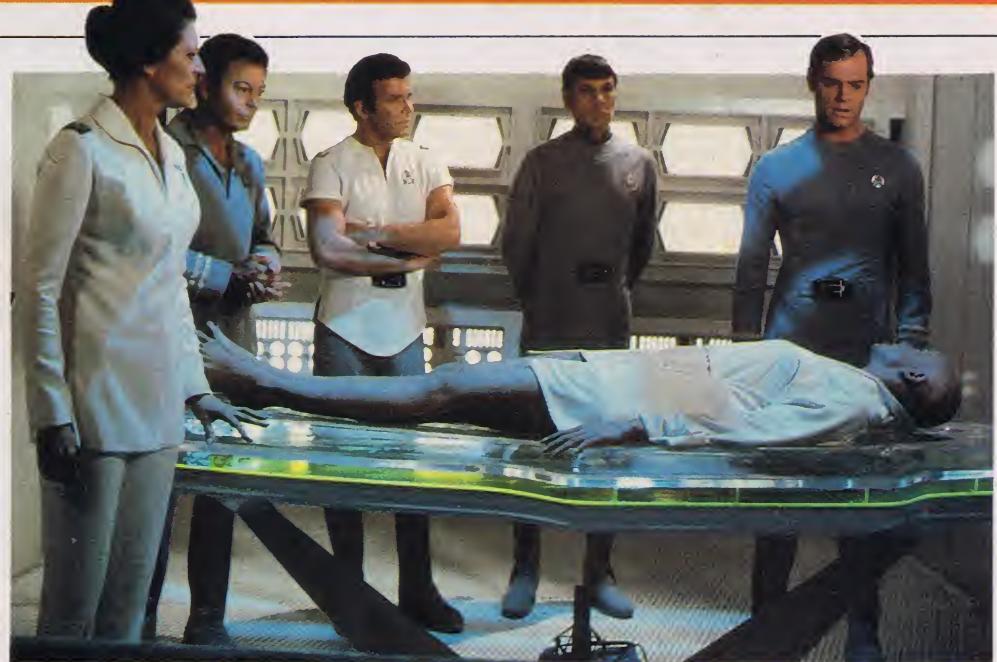
TRUMBULL "IN" ON STAR TREK

Doug Trumbull, the special effects wizard responsible for the mind-boggling magic of *Close Encounters of the Third Kind*, has officially been appointed as the head of special effects for *Star Trek—The Motion Picture*, thus replacing Robert Abel and Associates.

Apparently Abel, best known for his spacey Levi TV commercials, simply "blew it" in his position as head of special visual and optical effects. According to informed sources on the Paramount set, Abel was simply "underqualified." As the scope of the *Star Trek* motion picture became evident, Abel embarked on a series of financial squabbles with studio chiefs. An original estimate for special effects of \$4 million was quickly re-estimated to \$12 million; a figure which did not sit well with Paramount execs.

Adding insult to injury, Paramount officials found out that many of the effects already shot by Abel and his crew on the original \$4 million budget were totally unusable. Abel, apparently unacquainted with movie making practices, pulled several costly boners. According to one source, a series of test explosion shots were filmed in 16mm. This practice is practically unheard of in motion pictures. Usually, a test is shot in 35mm. If the test comes out spectacularly, it then can be blown up to 70mm with no problem and no severe injury to the budget. In 16mm, if an explosion looks spectacular there is nothing you can do with it except show it at home movie parties.

Paramount, at this point, was becoming quite alarmed. Gradually,



Prone Persis Khambatta is observed by newcomer Stephen Collins (right) and some familiar faces.

many of Abel's duties were siphoned off. Matthew and Richard Yuricich were put in charge of matte paintings and opticals. Bill Millar was given minatures to work with. The three had worked on *Close Encounters* with Trumbull and, prior to that, *2001*. Trumbull, by this time, was called in by the studio in a trouble-shooter capacity. Both Paramount and Abel Associates kept the news from the press. The story broke regionally in a recent issue of *New West*, magazine which detailed Abel's final downfall rather graphically. According to the publication, representatives from Paramount and Abel's company gathered to screen all of Abel's effects done for the film thus far. The audience included Trumbull and *Star Trek* director Robert Wise, a man known for his patience. According to *New West*, "Wise, during the

screening, reportedly became visibly angry at one point."

The following day, Paramount execs came to the conclusion that only one of Abel's effects was usable. The day after that meeting Abel and over one hundred of his crew were canned. Abel's work (or lack of it) as well as other delays will probably boost the overall cost of *Star Trek—The Motion Picture* to over \$30 million.

Complicating matters even further is the fact that, in order to reshoot key effects scenes, the "live" actors appearing in those scenes have to be recalled. Everyone is available for reshooting except for William Shatner, so a few key scenes involving Kirk, Spock and an alien intelligence are being rewritten for Spock alone. This rewriting calls for several spacesuits and interior sets to be redesigned, costing the studio even more money.

(This last-minute reworking effort may also lead to the elimination of a scene featuring Spock on an exterior Vulcan set.)

Still, Paramount is not all that worried about the cost. With Doug Trumbull at the helm, the effects should be the greatest in the history of SF cinema. However, the studio is trying to downplay the Abel affair and the Trumbull move as much as possible. Said one Paramount executive, "Doug is a Paramount employee and has been for close to six years. He's always been involved in the *Star Trek* project as a Paramount employee. Other people are being hired to take the place of the Abel staffers."

Meanwhile, the cameras keep on rolling on the Paramount lot. Where is Spock and his Vulcan death grip when you really need him?

—Joseph Kay

NEWEST RELEASE



SPACE ART CLUB Print #4, "Duststorm on Mars"
Painted by Ludek Pesek

Ludek Pesek is widely admired for the beauty of his alien landscapes. Born in 1919, the Czechoslovakian-born artist first entered the world of space art as a student; "bored with physics," he spent his class time making sketches of the solar system. He is well known for his many illustrations for *National Geographic*, notably in the articles "Voyage to the Planets" published in August, 1970, and "Journey to Mars" published in February, 1973.

"Duststorm on Mars": A billowing dust storm races across the barren surface of the red planet. The miles-high "wave" is about to engulf a desolate landscape covered by scattered rocks and windblown sand in the foreground with rolling hills and crater-pocked terrain in the background. Mars has always been a favorite subject with this astronomical artist. Another Pesek Marscape is featured in the centerspread Gallery of *FUTURE LIFE* #9.

A limited number of Space Art Club prints are available for individual purchase. The high-quality, suitable-for-framing fine art print is 22" by 30" and is shipped in a reinforced cardboard tube. Space Art Club prints #1, #2 and #3 are also available in a limited quantity. Order soon—when our supply of prints is gone, money will be returned.

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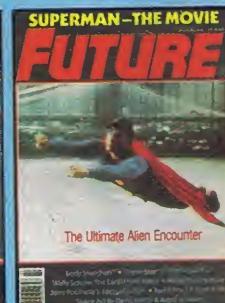
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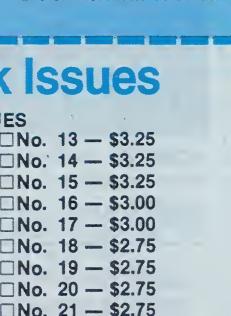
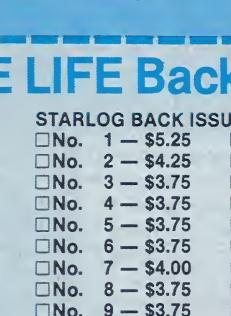
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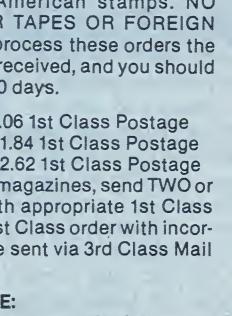
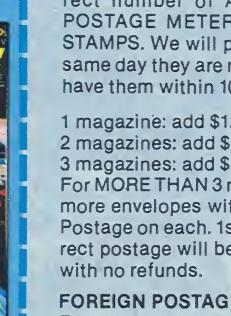


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SON OF GALACTICA

BUCK ROGERS TAKES OFF

With the release of Universal's new *Buck Rogers*, producer Glen (Battlestar Galactica) Larson envisions the beginning of a whole new science fiction film series. "So far," he says, "audience response has been terrific. They see Buck as a sort of Burt Reynolds in space or a James Bond in space, which is just what we intended to do with the script."

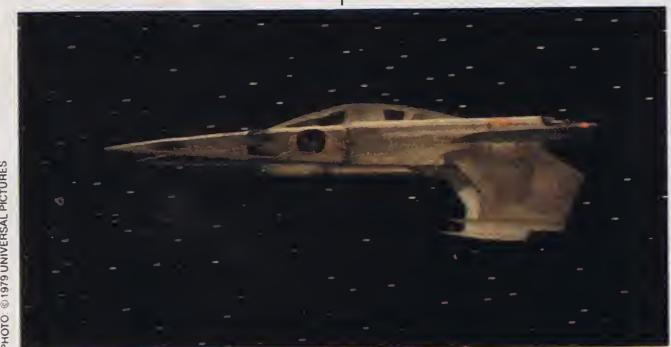
"Basically, *Buck Rogers* is the story of a man of today catapulted into the 25th century through a freak accident. Buck has a sort of contemporary, off-the-cuff Burt Reynolds sense of humor. That humor is necessary for him to survive in the future. Everyone he has ever loved is gone. His whole world is gone. With that sense of humor, he is able to deal with the 25th century. He circumvents the trauma of isolation. That humor also gives us

a chance to introduce a lot of Bond overtones. The wryness. It's something an adult audience can pick up on. The picture plays on two levels. It has all the expected appeal for a young audience, but it has enough satire to get to adults."

Larson admits that he took a chance producing Buck. For one thing, it's regarded in some circles as sheer comic book stuff. Adding to that problem is the fact that it boasts no superstars in the cast. "I think the lack of superstars actually helped the picture," Larsen says. "When you have a story set five hundred years in the future populated with recognizable celebrities it takes away from the illusion."

Larson has big plans for Buck Rogers once his first solo flight is over. "I'd love to see Buck come out once a year with a sequel," he enthuses. "Sort of like James Bond does. Plus, NBC has an option on it as a regular series. That's still up in the air, though, because of financing. These pictures are expensive to make. You just can't knock 'em out . . . not even in the 25th century."

—Ed Naha



A 25th century Earth forces space fighter, a la *Buck Rogers*.

PHOTO © 1979 UNIVERSAL PICTURES

EDUCATION

CLASSROOM FOR SPACE COLONISTS

As more and more young people are planning to take part in the colonization and utilization of space, universities are creating courses to fill their needs. At California State University in Northridge, a special summer program is being offered on "The Industrialization and Settlement of Space." According to the course brochure, the program will concentrate on "the sociological dimension of the move into space—the impact on the quality of life on Earth, the implications of change, the political, cultural and psychological problems and potentials in new roles,

new products, new occupations, new solutions to old problems and new challenges." Scheduled speakers for the summer '79 course include Dr. Krafft Ehricke, president of Space Global, Inc.; Dr. Peter Vajk of Science Applications, Inc. and author of *Doomsday Has Been Cancelled*; Dr. Richard Johnson, chief of NASA's Bio-Systems Division at the Ames Research Center; and other representatives from various industrial and military space concerns.

"The Industrialization and Settlement of Space" will be running on weekdays from June 25th to August 3rd, and will cost \$128. For more information and application forms, contact: Dr. B.J. Bluth, Dept. of Sociology, California State University, Northridge, CA 91330; phone (213) 885-3591. —Barbara Krasnoff

HAMBURGER HELPERS

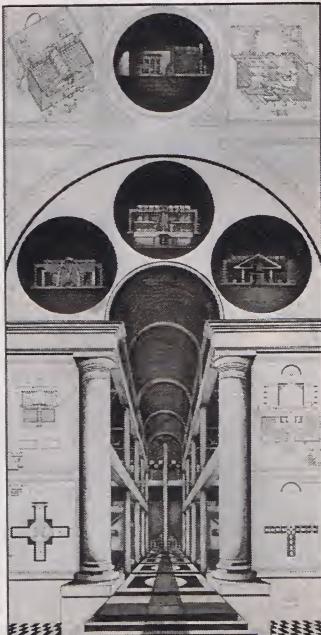
ONE NATION, UNDER BIG MAC

When Woody Allen, in his film *Sleeper*, strolled past a 22nd century McDonald's, audiences may have laughed—but the executives of America's hamburger empire did not. Instead, firm in the belief that fast food is future food, the McDonald's Corporation, with the help of the Association of Student Chapters of the American Institute of Architects, held a competition for the most innovative design for a McDonald's of the future. The contest, which ran from September through November of 1978, was open to full and part time architectural students, and will be shown as a traveling exhibit during this year.

First place went to Richard Pielli of Pratt Institute in New York, for his design entitled "MacSeasonal." In this highly environment-conscious structure, hungry customers will munch on their Big Macs amid a veritable forest of trees and gently curving walls. One can envision a futurescape in which urban consumers line up for blocks just to get a glimpse of the only greenery within miles of the city limits.

Other front-runners included a McDonald's which changes design to match the surrounding architecture (such as a shingled restaurant in Newport and a Jeffersonian building in Charlottesville); and a "yellow brick road" throughway lined with palm trees and sporting an M-shaped rainbow.

But the most interesting entry came



An awesome vision of the McDonald's of the future, as conceived by two Chicago students. Equal to art and religion?

from fifth place Honorable Mention winners Patrick J. Burke and Ricky Lukasik, both of the University of Illinois in Chicago. They envisioned a vast, cathedral-like structure which (and I quote the American Institute of Architects' press release): "...architecturally interprets McDonald's own self-perception as a social and cultural necessity—equivalent in scope and influence to religion, art and music." Presumably, with a statue of Ronald McDonald as the reigning deity. —Barbara Krasnoff

SF SCAVENGERS

"TREK" SECRETS FOR SALE

Much to the dismay of everyone connected with *Star Trek—The Motion Picture*, copies of the film's top-secret script are currently being



PHOTO © 1979 PARAMOUNT PICTURES

Early *Enterprise* painting.

sold on the West Coast via an SF black market ring at prices ranging from \$50 to \$100. The storyline of the film, as most *Trek* fans know, concerns the attempts of a refurbished *Enterprise* to stop a mysterious life force, which destroys all matter in its path, from engulfing and destroying the Earth. What is not known in most circles is what the essence of this life force is. The script reveals it to be a returning Voyager spacecraft which, picking up space life forms along its route, is returning to Earth to meet its Creator...NASA. The *Enterprise* journeys inside the mass for a Spock-to-brain chat. A slam-bang finish is guaranteed for all...including the California culprits who are selling the pirated script. Paramount's legal eagles are hot on the trail.

—Joseph Kay

RADIOACTIVE DUMPS

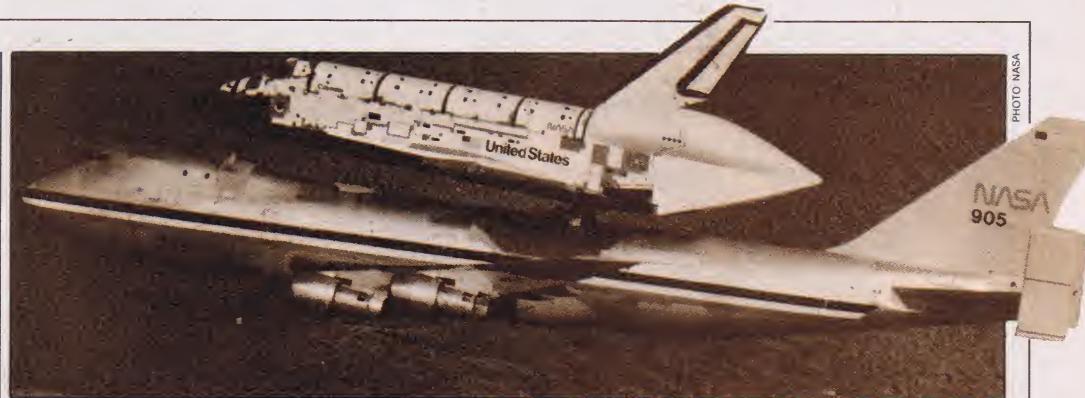
SHUTTLING NUCLEAR WASTE TO SPACE?

Ever heard of a crater on the Moon called Billy? No, it's not named after President Carter's brother, but it may be the site of a future nuclear waste dumping ground, according to studies by the Department of Energy (DOE) and the National Aeronautics and Space Administration (NASA).

With millions of gallons of high level radioactive waste produced by this country's nuclear reactors, where to store the dangerous by-product concerns scientists and engineers, as well as the general public. Thought has already been given to placing the waste in underground salt mines or on the ocean floor. But with the technical sophistication of the space shuttle, outer space could offer an acceptable economic solution.

In recent hearings before the U.S. Congress, R.D. Ginter, Assistant Associate Administrator for NASA's energy programs, suggested that space may prove to be an "alternative solution," requiring no more than current technology to "develop a space-based nuclear waste disposal program. It appears that it would be possible to demonstrate an operational capability if the nation wanted by the mid-1980s," Ginter testified.

Sounding like something out of the television series *Space: 1999*, Ginter related that NASA has gone so far as to pick a potential nuclear waste location on the lunar front side—a crater



Space shuttle orbiter *Columbia* makes its first flight cross-country on the back of a 747

40 kilometers wide by one and a half kilometers deep, labeled Billy. This spot was chosen, states a NASA report, because "it is not near any other interesting lunar formations which might be explored at a later date." An added bonus for placing nuclear wastes at the lunar site would be eventual retrieval of the matter—minus its radioactivity.

The heart of the space disposal plan centers on continual use of two space shuttles, one to take the radioactive cargo into low Earth orbit, while a second shuttle would carry an Orbital Transfer Vehicle (OTV)—a nuclear waste-carrying garbage scow. Using mechanical arms, the packaged waste would be coupled to the OTV, and then boosted out of Earth orbit to a selected trajectory. After slinging the waste package onto a proper course, the OTV would return to one of the shuttles for recovery and later re-use.

Along with Moon storage, NASA and the DOE have investigated shuttling nuclear garbage into high Earth

orbit, in orbit around the Moon, solar orbit, as well as launching the waste matter directly into the Sun. This last concept is beyond the capability of current chemical propulsion systems, and thus was temporarily ruled out. *Orbiting* the material around the Sun, however, is being viewed as a second option, along with the lunar storage technique.

But placing cannisters of radioactive waste in open space does have its problems, admits NASA. It may prove impossible to build containers to last 250,000 years, the time it would take for the waste to become decontaminated. Eventually, worries the space agency, the container might erode, spilling the waste into free space, with the solar wind blowing the matter back at Earth. Also, the thought of several hundred nuclear waste containers orbiting in high Earth orbit "would probably be the last one to gain public acceptance," notes one report.

One additional plan has been sug-

gested by Dr. Charles Hyder of NASA's Goddard Space Flight Center—shooting nuclear waste deep into interstellar space. With the nearest star light years away, the waste capsules would take over a million years to reach their destination. By that time, suggests Hyder, the radioactive material will have decayed to a harmless substance, thereby avoiding the dispatch of "radioactive surprise packages" to possible inhabitants of nearby stellar neighborhoods.

As for the safety of the disposal program, NASA states that a fail-safe container can be developed, able to withstand even a catastrophic failure of a shuttle on liftoff, or a crash in the open sea, without spewing its hazardous contents. A failure of the OTV could be detected in real time with corrective action taken immediately.

Although more studies are planned, initial findings tentatively suggest that the shuttle may provide yet another service—carrying out the nuclear garbage. —Leonard David

MARINE EXPLORERS

FLIPPER MEETS THE LOCH NESS MONSTER

Some marine biologists have long maintained that dolphins can communicate with humans. But can they get along with something like a sea monster? For instance, would a dolphin have anything to do with the ever-elusive Loch Ness Monster?

Scientists at the Academy of Applied Science of Boston are certainly hoping so. Dr. Robert H. Rines, a patent attorney who has ventured to Scotland's legendary Loch Ness every summer for the past decade in search of Nessie (as the creature is endearingly dubbed), will take two dolphins on the latest quest.

These are not just any dolphins,



Camera-carrying dolphins will search for the sea monster.

such as turtles and sharks. A group of dolphin experts from the Navy's San Diego Research Center have been advising during the training and they assure Dr. Rines that the dolphins are fit for the task.

Even so, for those who doubt that the dolphins can face the rigors of their deep-sea assignment, Dr. Rines guarantees that the "problems of using the dolphins in fresh water and at relatively lower temperatures have received very careful attention, with unanimous agreement that there is absolutely no danger or discomfort or strain on the dolphins."

Meanwhile... though the rumors are as of yet unconfirmed, FUTURE LIFE has learned that a team of undercover beavers operating in the Pacific Northwest have been secretly trained to follow scents and are hot on the trail of Bigfoot.

—Bob Woods

though. For the past several months the two cetaceans have been in intense training in Florida. Lessons have included a crash course in underwater lighting and photography as well as learning to survive in cold fresh water rather than their customary habitat of

warm salt water.

According to Dr. Rines, the dolphins have been successfully schooled to carry harnesses rigged with cameras and lights. They have already demonstrated their talents by finding, tracking and photographing other sea animals



PHOTO: 1979 CAPITOL RECORDS

The anonymous members of Klaatu pose in a proposed kartoon.

SPACE SOUNDS

KLAATU COMES OUT OF THE KLOSET

In August of 1976, a mysterious Canadian band called Klaatu released its debut album. The group refused to have either their names or photos on the album jacket, preferring a science-fiction portrait of the Sun instead. Three years later, all that's known about Klaatu is what was known in 1976. Klaatu is a self-contained, four-member group based in Canada. They took their name from the character Michael Rennie portrayed in the classic, *The Day The Earth Stood Still*.

Klaatu's first LP was an SF theme piece, detailing life—past, present and future—on a planet called Klaatu. Their second LP, *Hope*, chronicled the adventures of a group of space travelers who visit the remnants of a distant civilization...the same civilization which fell at the close of their premier LP. Their third LP, *Sir Army Suit*, found the group returning to Earth and penning tunes about Charles Manson, Tim Leary and perpetual motion machines. Despite their fame, Klaatu has chosen to remain totally anonymous for three years. At one point, their anonymity caused a rumor to surface that Klaatu was really a re-united Beatles, a band they resemble stylistically.

"Not true," says a Klaatu member identified only as "John" over a phoneline from Canada. "Klaatu is Klaatu. The whole Beatle rumor just happened because people were frustrated at not knowing who we were. As for the anonymity bit, who really cares about that? If we choose to avoid the spotlight, why should

anyone care?

"The band took the concept of Klaatu from *The Day The Earth Stood Still*. We felt that the movie carried a strong message and we identified with the central character, Klaatu. He was an individual who brought a message of intelligence to the people of Earth. He held up a mirror for them to gaze at their lives in. He asked them, 'Here. Look what you're doing. Does this *really* make any sense to you?' In a sense, that's what we've tried to do with our albums. The anonymity has helped us. You tend to listen to someone more if you don't imagine them in disco outfits and frizzy hair."

Despite their interest in science fiction fables, the four members of the band don't consider themselves an SF band. "No, we're not really science fiction oriented as a unit, although we've used SF and futuristic fantasy in our last three LPs. We've also included songs about historical fiction, rock and romance, too. We like to think that we're diversified."

At this point in time, Klaatu is so pleased with its faceless brand of futuristic rock that, with the release of their fourth LP sometime late in '79 or early in 1980, they will come out of the closet, showing their faces for the first time. "It will be a gradual thing," John laughs. "We started it on our last LP when we allowed drawings of us to appear on the cover. This year we'll do a few TV shows. Next year we'll tour. For the first time Klaatu will bring its message to the people in a one-on-one situation."

Asked whether Klaatu's emergence into the spotlight will dilute their spacey bouts with sociology, John laughs. "Not really. In the film, Michael Rennie showed his face when addressing the Earth. Even without his mask, he had a lot of important things to say." —Ed Naha

HARDWARE

ROCKET POWER STALLED

In the early days of science fiction, the citizens of the future were often pictured zooming around the countryside in their own personalized flying belts. Hopes were raised that this could become a reality when, in 1961, Bell Aerospace Textron came out with their widely publicized Rocket Belt.

Unfortunately, that is about as far as it got—or is likely to get for a while, according to the people at Bell. After manufacturing two of these Rocket Belts (one is now in the Smithsonian, the other at Buffalo's State University of New York campus), production seemed to cease.

Not that the concept has died entirely. A Jet Flying Belt, subsequently developed by Bell under contract for the Department of Defense, was considered an improvement over its predecessor and said to be applicable to a number of military and civilian purposes; however, none have been considered suitable for the public market. The Williams Research Corporation in Walled Lake, Michigan, was granted a license to manufacture, use and sell the Bell Jet Flying Belt. They are instead currently concentrating on the development of a newer version, the WASP (Williams Aerial Systems Platform).

So, until further notice, the rocket belt of the future is still waiting for the future. —Barbara Krasnoff



PHOTO COURTESY OF BELL AEROSPACE TEXTRON

The Rocket Belt gave hope to future flyers, but hasn't gotten off the ground commercially.

MEDICAL RESEARCH

MINI-BRAIN STORM

A new method of studying the interactions of the brain through the use of living "mini-brains" may someday lead to such futuristic possibilities as increasing the mental capacity of normal individuals, according to Dr. Joseph Neale of the National Institute of Health in Washington, D.C.

Along with Drs. Jeffery Barker and Thomas Smith, Dr. Neale has been studying the basic nervous system and how it reacts to opiates and anti-anxiety agents such as Valium. According to Neale, "The brain produces its own opiate-like compounds (called enkephalins), and nerve cells have specialized receptors which permit them to use these natural opiates for communication between cells." In

other words, it is possible that the human brain has some natural Valium-type substance which it uses during normal activity, perhaps to control tension.

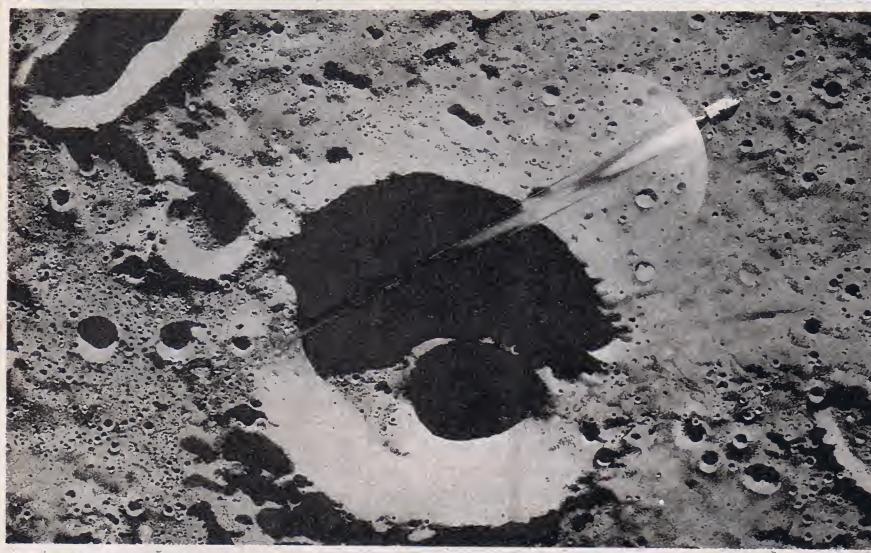
But how is it possible to study such a complex system as the brain, with its hundreds of billions of interconnecting nerve cells? The scientists decided to try using a vastly simplified version. They removed the brains and spinal cords of embryonic mice and, placing them in a special culture, studied the functions of these "mini-brains."

It worked perfectly. Through trying to pinpoint the working of enkephalins, scientists now feel that they can not only discover the basis for a variety of emotional or mental disorders, but additionally help develop more efficient, non-addictive painkilling drugs and even, someday, enhance the mental capacity of normal individuals.

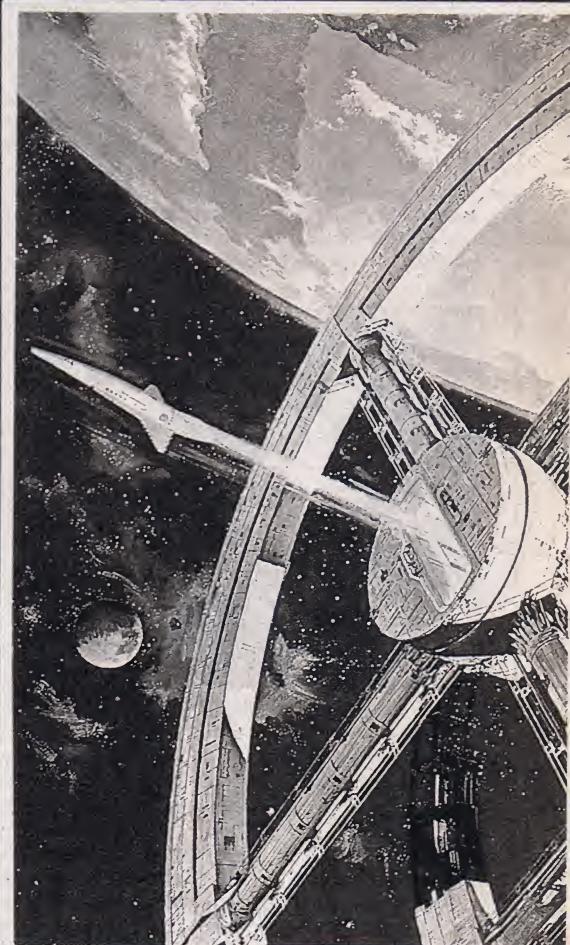
—Barbara Krasnoff

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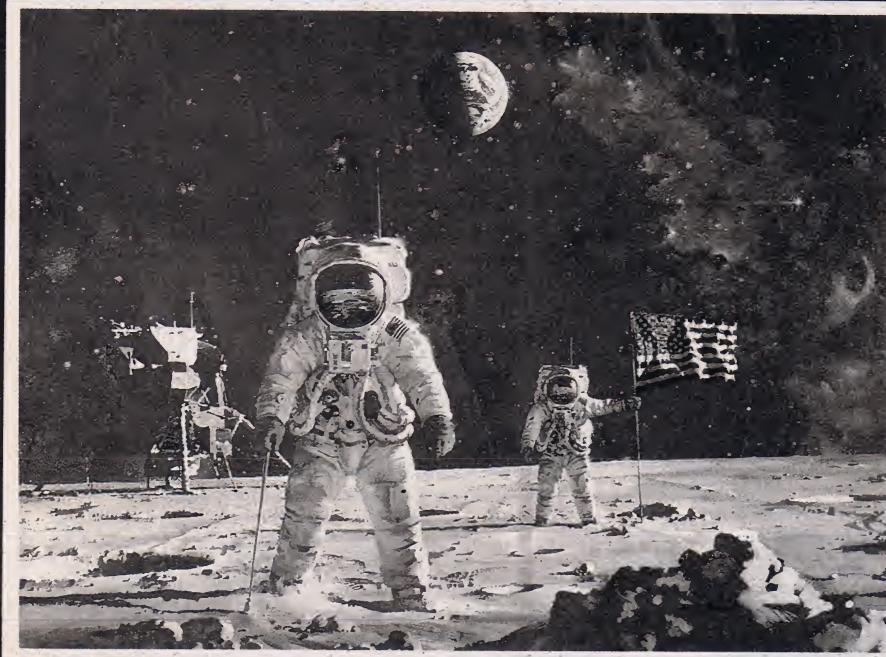
Robert McCall's Classics Now Available Individually



"Apollo VIII Coming Home" (NASA Collection)



"Space Station One" A 24 x 28 inch lithograph



"First Men On The Moon" (Private Collection)

In the future Man will use his down-to-earth technology to reach deep into the awesome infinity of outer space. Robert McCall has already been there. He has a mind that spans time and space, an eye for technical detail and the hand of a great painter. His spectacular Space Station One, created for the film "2001: A Space Odyssey," has become a collector's item and a contemporary classic. Frequently commissioned by NASA to do on-the-spot paintings of America's ventures into space, McCall is always present for important launches and splashdowns. His oil paintings have gained international acclaim reproduced as U.S. Postage Stamps, one of which was the first stamp cancelled on the Moon, and another, his most recent, commemorated the historic

Apollo-Soyuz space rendezvous. McCall's work hangs in important museums, corporate offices and private collections around the world, and he has been honored in a one-man space art show at the Smithsonian Institution.

There is no question about it, Bob McCall is the premier space artist of this generation. Now offered are three gallery-quality lithographs of McCall's work. These are incredibly detailed, beautifully colored paintings of Man's greatest journeys. Each 24 x 28 inch lithograph is accompanied by a descriptive statement in the artist's own words. Each lithograph can be acquired for \$10. This limited collector's edition has been authorized by the artist and FUTURE LIFE Magazine guarantees your complete satisfaction.

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SEA SIGHTS

WHALE MUSEUM SURFACES

The resort town of Friday Harbor, in Washington State's scenic San Juan Islands, is the site of a unique and hopeful venture; the world's first museum devoted exclusively to whales.



Curators Anderson and Howell.

"Other museums feature whale exhibits, and a couple deal with the history of 19th century Yankee whaling," says Mark Anderson, the museum's 27-year-old curator. "But, as far as we know, ours is the first and only undertaking of its kind: devoted to the study and preservation of whales, rather than chronicling their extermination."

Featured will be an abundance of audio-visual displays designed to edu-

cate the public about whales' migrations, biology, physiology, hydrodynamics, 'songs,' and endangered status. Visitors will eavesdrop on cetacean conversations, trace the 12,000 mile migration of gray whales, re-live American Indian whale mythology, view films of whale behavior and meet the guest of honor—the skeleton of an orca identified as L-8, whose life history will be on display. A computer will answer their questions about marine mammals, and they'll be able to follow the meanderings of local orcas on a real-time display, constantly updated by Balcomb's phone in 'Whale Hotline.'

Anderson notes that the Museum will serve scientific, as well as recreational and educational needs. "We're setting up a worldwide data bank coming straight from the horse's mouth—the research scientists who gather it. Very little is known about whales, and the information is widely scattered. There's an urgent need for scientists to pool and correlate their knowledge if we're to save the whales from extinction."

To finance this ambitious program, the Museum is offering memberships. Rates are: students and sr. citizens, \$5.00 per year; individuals, \$10.00; families and supporting, \$20.00; honored, \$50.00; life, \$100.00; and regent, \$500.00. Contributions and inquiries can be sent to: The Whale Museum, P.O. Box 1154, Friday Harbor, Washington 98250. Even if you're not planning a trip to the Evergreen State, your donation will help keep the world's biggest mammals from going under—permanently.

—Malcolm Brenner

ANNIVERSARY CELEBRATION

HAPPY 3RD BIRTHDAY STARLOG

That's right, as of issue #24, STARLOG begins its fourth year of providing readers with the latest information from the multi-faceted world of science fiction.

To celebrate, the editors are presently putting together a spectacular third anniversary issue, which promises to be the biggest, most exciting STARLOG yet. For the occasion, the magazine is expanding to 96 pages, including a special 32-page, all-color section filled with retrospective highlights of the first three years.

In addition, there'll be exclusive interviews with *Trek's* William Shatner and Leonard Nimoy, a colorful tour of Jupiter's moons, a *Moonraker* preview and a conversation with



Alien's co-producer, Walter Hill... plus all the exciting regular features that have made STARLOG the greatest science-fiction magazine ever. Watch for this sensational anniversary celebration at newsstands beginning June 5.

SPACEY CINEMA

BLACK HOLE TAKES DISNEY TO SERIOUS SPACE

"Beyond hope, beyond fear, beyond science—the most terrifying force in the universe. Nothing can escape it... not even light!"

That's the narration for a two-minute trailer film currently touting Walt Disney studio's monumental Christmas release, *The Black Hole*; a \$17.5 million science fiction opus that may be a landmark Disney film in more ways than one. *The Black Hole* is the most expensive movie in the studio's four-decade existence and the company's biggest gamble since namesake Walt risked his reputation to build a groundbreaking amusement park some 24 years ago. Plotwise, *The Black Hole* also breaks with Disney tradition.

A straight science fiction adventure penned by Jeb Rosebrook and Gerry Day, the movie strays away from the current, whimsical Disney train of celluloid thought, detailing the exploits of a lone starship encountering a black hole in deep space. The movie stars Maximilian Schell, Anthony Perkins, Robert Forster, Ernest Borgnine, Joseph Bottoms and Yvette Mimieux; a cast which does not fit into the established, light-hearted Disney mold.

"We wanted an international cast of important actors who hadn't worked at Disney before," Martin Rabinovitch, Disney's director of market planning, commented to the news media recently. "We wanted to let people know that this was a new kind of movie, that we are now going to pursue stories that are a bit broader."

Disney studio's pursuit of "broader" storylines comes at a time when the studio is attempting to recapture the young adult audience; a teen-aged crowd that once flocked to



Harrison Ellenshaw on the set.

see such features as *20,000 Leagues Under the Sea* but has avoided such recent Disney releases as *Freaky Friday* and *The Apple Dumpling Gang*. The studio, which once was able to effortlessly produce such high flying adventures as *Leagues*, is making an all-out effort to return to those high standards of filmmaking. Supervising the out-of-this world production designs for *The Black Hole* will be matte artist extraordinaire Peter Ellenshaw; the British genius who was responsible, by the way, for much of the splendor of Disney's *20,000 Leagues Under the Sea* some 25 years ago. Ellenshaw was actually talked out of retirement by the eager Disney camp, who wanted *The Black Hole* to simply reek of quality. Aiding the elder Ellenshaw with the matte work will be son Harrison Ellenshaw (formerly known as P.S. Ellenshaw), who did the excellent matte paintings for *Star Wars*.

The Black Hole may indeed win back the wan young adult crowd into the Disney camp. Studio executives, however, want to stress that the movie will be PG, an exciting film, but a family film nonetheless. Serious science fiction, it would seem, fits nicely into the ever-expanding Disney niche. "Science fiction," Rabinovitch acknowledged, "like animation, is free form."

—Joseph Kay

COMING

For theatrical release in 1979
from SF Film Productions

HIGH-FLYING PHOTO SHOW

Seen from the vantage point of above, whether it be from a serenely floating blimp or a speeding interstellar spacecraft, the Earth is transformed. Our planet becomes an awe-inspiring work of art.

A new aerial photography exhibition, "Our Beautiful Earth: The View From Air and Space," opens this month (May) at the Smithsonian's National Air and Space Museum in Washington, D.C.

Showcasing more than 70 photographs, the exhibit spans the incredible range of aerial photography. It includes early pictures snapped from kites and balloons, one photo taken by a camera-carrying pigeon, and the first spectacular shot of the Earth and Moon in one frame—as photographed by the Voyager space probe in 1977, from a distance of seven and a half million miles.

Incredible vistas captured on film by astronauts aboard the space station Skylab are featured, as well as some dramatic computer-enhanced images returned by the automatic

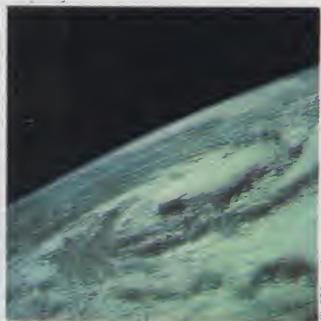


PHOTO: GEORG GERSTER

Earth resources satellite, Landsat.

Four photographers who specialize in aerial photography are spotlighted in the exhibition. Three of the high-flying shutterbugs—William Garnett, Georg Gerster and Robert Bucknam—shoot from small aircraft at altitudes of 100 to 1000 feet. The fourth, George Hall, has a passion for photographing from blimps. Happily, the Goodyear folks have accommodated him with excursions on their four airships, a total of 2500 hours over a period of five years.

The Air and Space Museum's exhibit, now on display in the Flight and The Arts Gallery, will run for at least a year. The museum is open seven days a week, until 9 p.m. through Labor Day. Admission is free.

—Robin Snelson

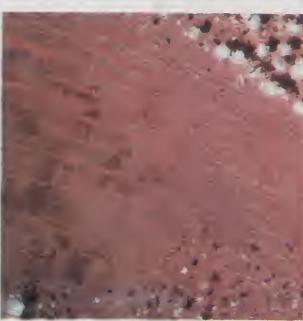


PHOTO: NASA

Clockwise: Pacific cyclone from Skylab 4; village in the Niger, Mali; Sahara dunes from Skylab 3.

SCIENCE FICTION TO FACT

23RD CENTURY NOW

When *Star Trek—The Motion Picture* hits the screen, *Enterprise* crewmembers will have replaced their hand-held, flip-top communicators with sleek new models worn on the wrist. The technology update was suggested by the film's science advisor, FUTURE LIFE contributor Jesco von Puttkamer.

But this wrist-radio communicator isn't really 23rd century stuff, according to Puttkamer, whose NASA job involves future planning for the space program. The inexpensive wristcom could be manufactured today, just as soon as the expensive satellite that will make it work is situated in synchronous orbit above Earth. The wrist-radio was conceived by Ivan Bekey who believes that large sophisticated "switchboards in the sky" could make the futuristic device an inexpensive and common means of communication in the not-so-distant future (FUTURE LIFE #10, Databank).

While this drawing doesn't represent exactly what the well-dressed



calls through the satellite switchboard," explains Bulova's Gowen. "The wearer can also interrogate Information, receive voice-operated time service information and call Operator. All the responses would be generated by on-board computer systems in the satellite."

The nuts and bolts of the Bulova design include a 10-digit phone number (at top in white digits), a 10-button dialing system (white buttons with black Arabic numerals 0-9), a digital time readout (orange-red digits, centered in 10-button dialing system), additional control buttons (one green and one red, at bottom of case), setting buttons (on each side of case), speaker-microphone (at bottom, in foreground), and three antenna systems for receiving and sending signals via satellite (one on each side of the case, flush with the case, and a third running through the exterior of the flexible plastic bracelet). One innovation is incorporating the wristcom's battery power pack in the plastic bracelet. When the power is exhausted, the entire plastic bracelet is replaced.

"It's not really 'Star Trek,'" Puttkamer emphasizes. "If we had the satellite, it could be today."

—Robin Snelson

UFO THEORY

YOU LIGHT UP MY NIGHT

When Dr. Phillip Callahan, an entomologist, read a book about UFO sightings in Utah, the reports "bugged" him. Within the pages of *Utah UFO Display*, 200 reliable witnesses described darting, glowing flying saucers they saw in Utah's night sky. "Hey," Callahan thought as he read the reports, "these things move like insect swarms."

Now employed by the U.S. Department of Agriculture, Callahan recalled seeing swarms of migrating locusts while traveling in Asia. "They had saucer shapes and long shapes... and they hummed," he observed. He also remembered that when he was in the Air Force during World War II, the wings and props of airplanes sometimes glowed during night flight due to a phenomenon called "corona discharge."

Could swarms of insects glow in the same way if caught in an electrically charged storm front? he wondered. After performing experiments in a USDA lab he found out.

"It's impossible for them not to light up in an electrically charged field. They not only give off a visible bluish glow, they emit black light, too." A disco light show in the sky.

Checking further, Callahan found the Utah UFO sightings correlated almost perfectly with infestations of spruce budworm moths in the same area. He suspects similar correlations will be found between migrations of other insects and many of the 30,000 nocturnal UFO sightings in the Air Force's *Project Blue Book*.

As for corona discharge, Callahan says, "there's nothing mysterious about it. It's the same effect that creates Kirlian photography." It's caused by electrons pulled off the insects flying in a charged field, which creates friction with nitrogen in the air. "All they would have to do is get under a storm cloud, become very uncomfortable and try to get out of the charged field, and it would look like they were shooting off into space."

Although you would not be able to see one single insect under such conditions, a large swarm would be visible for miles.

"The punchline," says Callahan, who reported his findings in a scientific journal called *Applied Optics*, "is that we may be able to learn insect migration routes by comparing infestations with UFO sightings."

—Allan Maurer

One recent lunch hour, on the mezzanine floor of New York's towering World Trade Center, a crowd of astonished office workers gathered around a small glass cylinder. Attracted by a peculiar aura of white light, the people in the crowd, with their fingers and faces right up against the cylinder's glass, were trying to understand just what was going on inside.

At first glance it looked like a little dwarf was being held captive within. What's more, the little man was blithely playing a saxophone. The runt was so natural, so

clearly flesh and blood—and certainly three-dimensional—that the effect was a little unsettling. Unable to hold himself back, one viewer reached inside the cylinder with his hand to see if anything was really there. His fingers closed on empty space.

He had just entered the world of holography.

What does this strange word "holography" mean? Briefly, from the Greek, *holos* translates as whole and *graphos* comes across as message. The whole message: a hologram is the whole message. Not just art imitating life, or

Right: The Museum of Holography, 11 Mercer Street in New York City. Spread: A close-up of a 120° white light integral hologram showing the individual holographic strips produced from ordinary movie footage.

PHOTO DAVID HUTCHISON



technology trying to do the same, but rather art and technology combining to provide a time encapsulated whole message of a moment that actually occurred. You've seen photographs, and you've probably seen a movie or two, and maybe even a painting by a great master which purported to represent a given moment in space. We can now forget any claim an artist or photographer may make about recreating a moment. They haven't got the half of it.

"One quality of holography is its ability to modulate time—time in space," says Posy Jackson, director of New York's

Museum of Holography. "A hologram records reality as a total three-dimensional volume of activity, and it is able to reproduce 'real time' as well. Some people even say that the hologram is the precise model for the way the human brain's memory storage mechanism works."

Coherent Light

One way to picture what a hologram can do, short of actually seeing one, is to understand how they are made. To begin, one goes back to basic physical laws, light waves in particular. The light waves the

human eye normally receives are nothing but a hurly-burly pattern of jagged crests and troughs classified as *incoherent* light. When a photograph is made, these incoherent waves are trapped in the emulsion of a film, having first bounced off the person or thing being photographed. They don't arrive on the film in any intelligent ordered pattern, but they do arrive strong enough to register a two-dimensional image. The light waves from *behind* the subject being photographed never arrive. Rather, they go bouncing along off the wall, into space, or onto the ceiling.

A picture is worth a thousand words—that's a pretty old cliche.
Then imagine the value of one hologram, an image worth a
thousand pictures.

HOLOGRAPHY

The Whole Message

By JAMES C. ODELL

But laser light is so orderly that physicists call the waves they produce "coherent." Beam a strong enough laser out your window and toward the Moon and the waves will arrive there in the same phase in which they stepped out. Take a laser light wave and beam it at and around a person or an object. Then make those waves—which never get out of perfect lock step and rhythm—enter the emulsion of a highly sensitized piece of film and you are on your way to making a hologram. The coherent light waves will carry *all* the information about the subject being photographed—three out of its three dimensions.



fold their images into a deep enough emulsion for true three-dimensional sprawl.

And then an American, Lloyd Cross, contributed the next giant step. He made moving holograms that were visible in white (light bulb) light—even sunlight. Using a curved sheet that contained thousands of images, Cross' work brought holography into the 70s. His "movies" actually moved in three dimensions; looking at one from the side, a viewer saw a side view, from the front a frontal view, and so forth. Interestingly, Cross had originally worked at the McDonnell-Douglas lab in Ann Arbor that was developing a holographic bombsight, a frighteningly effective tool. Cross left the project to devote himself to non-destructive holographic applications, choosing to advance the art world instead of the military.

This was a seminal move, for artists were just as entranced as industrialists by the new medium. Salvador Dali was the first major artist to move into holography, saying, with characteristic humility, "With the genius of Gabor, a new Renaissance in Art has been realized. The doors have been opened for me into a new house of Creation." Dali's holograms are among the most haunting and elusive images that have ever been fashioned by human hands. An exhibition of some at New York's ultra-prestigious Knoedler Gallery signaled the arrival of that new house of creation in the art world. With Dali as the doorman, visual artists who enter this structure leave behind all the traditions and limitations that hold imagination down, exchanging brush and chisel for the laser beam and the sand table. "The time of the hologram is only now beginning," says Dali. "The hologram will be the King."

The Work of the Devil

Little Artoo Deetoo had a holographic message from Princess Leia to play back (in *Star Wars* it was pure SFX, not a real hologram)—demonstrating yet another use for holography. Holograms make great advertisements, and if you want to get somebody's attention you could do a lot worse than use a moving three-dimensional image that stands on thin air. New York's ritzy Cartier Jewelers used a hologram of a lady's hand with a huge diamond ring on her finger as a display for their Fifth Avenue store window. The enormous hand leaped into the street, or seemed to, with an eerie greenish diamond glow—attracting more curious shoppers to the store than any window display Cartier had ever created. There were several disturbances, however. One elderly woman fell to attacking the hologram with an umbrella, hacking away at the air in front of the store. Claiming it was the work of the devil and using the umbrella as a stake, she tried to thrust a shaft of righteousness into the Cartier window, and succeeded in breaking it. Holograms, it seems, cast no shadow and objects that have no shadow must be the work of the devil, according to an old adage.

No matter whose work they are, holograms are currently being used as display

"Thoughts," a hologram created by Kenneth Dunkley in 1973. The imagery is interesting in that it uses one hologram within another, producing a separate space within another space.

If you make a hologram of a glass of water, and then put the hologram under a microscope, the micro-organisms that were in the water originally will easily show up, something not possible with photography. Or take a large hologram (say 6" x 9") containing a 120° panoramic view of Chicago, in three full dimensions. Snip a tiny part of the corner of the hologram away from the rest, cutting out perhaps two percent of the whole. The same 120° view will appear in the tiny section as was present in the 6" x 9" "parent." Holograms are the whole message.

A History

The man known as the father of holography, Dr. Dennis Gabor, formed his theories of coherent light back in 1948. Gabor knew then that it would one day be possible to capture all the information about a subject on a piece of film. The only thing he needed was a source of coherent light, which did not exist at the time. But when lasers were developed in the late 50s, and really got going in the early 60s, Gabor and other pioneers had everything they needed to begin making holograms. With the coming of lasers, Gabor's theories were proven out, and so many holographic ideas were applied to problems in medicine,

technology, communications, and warfare during the 60s that Dr. Gabor was awarded the Nobel Prize for Physics in 1971.

Gabor did not actually make the very first hologram. Two disciples of his, Drs. Leith and Upatnieks of the University of Michigan, made the coup. Combining rudimentary artistic techniques with a spare helium/neon arc laser they managed to wangle, the two men fashioned the very first resolute hologram, a speeding train that seemed to hurtle straight out of its holographic plate and into the eye of the viewer.

They unveiled their breakthrough at the annual meeting of the Optical Society of

America in 1964. There, long lines of specialists leaned in to stare at the marvel. For weeks afterwards, the two researchers were swamped with requests for information on holography. When they produced their first lab data, it was quickly gleaned by a number of large corporations (Bendix, TRW and R.C.A., as well as NASA and the Jet Propulsion Laboratory) who, in the giddy technological atmosphere of the 60s, were determined to have a piece of this new miracle. Soon, a number of holography labs had been floated (McDonnell-Douglas being the most productive) and holography as a medium of the future was launched. To date, of all the organizations seeding research into holography, NASA has provided the most R & D money.

And Russia was not far behind. One early circumstance limiting the applications of holography was that lasers were needed not only to make plates, but to exhibit them as well. A Muscovite, Y.N. Denisyuk, invented a process that made holography practical for the public. He made holograms that were visible with ordinary white light bulbs (though still made with lasers), portable, and above all, cheap. In 1967, a cheap and effective film was developed and marketed by AGFA using dichromate gelatin, allowing potential holographers to

advertising for TDK recording tapes, in the largest ad campaign using holography to date. In a matter of months, holograms will be in audio stores across the country, acetate sheets bent on a 120° curve illuminating a pair of disco dancers, one of them pointing to a TDK tape. It is an extremely effective, moving, three-dimensional color gram and goes a long way to support the manufacturer's claim that his tapes enable the user "to enter a new dimension in sound recording."

Future applications for holography will lie in record album covers, store displays similar to TDK's, paperback book covers, and even bind-in ads in magazines. The manufacturing process already exists to reproduce a million holograms for about a penny each.

Meanwhile, the Russians are applying holography in a less profit-oriented way. Holograms as reproductions of works of art—sculpture in particular—are quite effectively being made in the USSR. Full 3-D moving holograms, allowing a viewer to walk around them to see a work of art from all perspectives, are currently being made. The holograms are then sent to workers' meeting halls across the vast country, distributing art that would otherwise not be seen in old Urkutsk, or quaint and chilly Siberia.

But this is just the public side to holography's many uses. Below the surface, in the medical, technological, and military sectors, holograms are in wide use. When Firestone Tires recently installed a policy of recalling all versions of a steel-belted radial tire, the evidence that they weren't worth putting on a Tinker Toy came from a hologram used to analyze stress.

NASA has been responsible for developing more uses for holography than anybody else; the medium's use both in the present and the future of the space program is assured. And IBM, Xerox, and Hitachi (among other giants) are all rushing to introduce holographic scanners as applied to the next generation of printing: high speed laser presses. Holographic scanning, where information is stored three-dimensionally in the depths of a tiny film emulsion, is the fastest, most accurate and space efficient way to store and retrieve input.

For doctors or medical researchers, holograms are extraordinary diagnostic devices. The Air Force was recently having problems with workers in a microwave-rich installation who were developing glaucoma and eye cataracts in alarming numbers. Without any anaesthetics, completely painlessly, three-dimensional holograms were made of workers' eyes *from the inside out*, giving doctors a perfect view from inside the retina. Holograms were also made of workers' eyes before and after they entered the microwave area. If glaucoma developed in the interim, then workers' claims were pressed against the Air Force and damages collected.

Holograms have also been made of a fetus inside a mother's womb, and of the organs inside the fetus' body. As in the case

of the hologram of the glass of water (which revealed microbes when viewed under a microscope), the precise 3-D scan allowed doctors their closest look yet into a living fetus, revealing individual organs, and heart or brain defects.

Precise contour maps can be made of any object, anywhere, and when the hologram is projected, it is virtually the same as looking at the object itself. One technique is called acoustical holography. Rather than using light waves from a laser which register in air, it uses sound waves which then register *in water*. The object to be holographed is first submerged, then two separate sets of sound waves are beamed at it, registering an interference pattern at the surface of the water. The wave information in this pattern is then passed into a computer, which produces the actual 3-D image.

Using this technique, a complete image was recently made of a monkey's brain. With different stimuli, researchers were able to tell exactly which *cells* of the brain were activated by different responses. This work, done at Stanford University, gave scientists the closest look they had ever had inside the brain of ape or man.

Another use for holography, which NASA has pioneered, is in the training of future astronauts via holographic flight simulators. Able to adjust to pitch and yaw, the absolutely life-like holograms of a planet provide highly accurate reproductions of landing, departure, and atmospheric conditions. Then too, NASA has developed a camera which is able to make holograms of objects found on a planet—such as a rock—and beam the grams back to Earth. Again, having a hologram of a Martian rock on Earth is almost as good as having the rock itself.

These are all wonderful, positive applications. But there are also horribly *destructive* uses that have been developed for holograms. The Air Force and the Navy have come up with holographic gun and bomb sights which make it possible to place a bomb or a bullet on the head of a pin, from a distance which the naked eye would read as infinity.

Here They Come

Whether for good or for evil, the age of holography is upon us. What will it offer?

(continued on page 57)

How to Make a Hologram

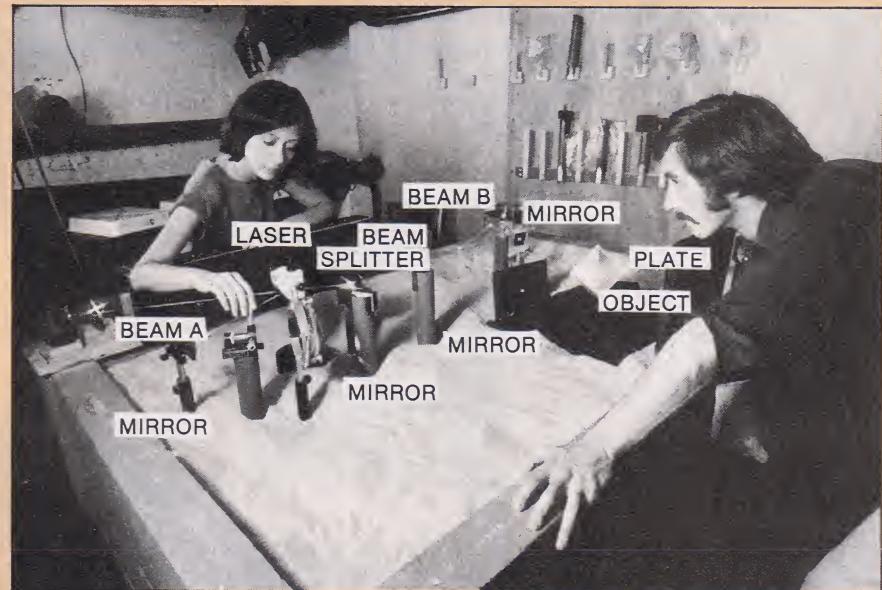


PHOTO © 1975 STEVEN BORINS

Holography is a three-dimensional imaging technique using laser light to record the patterns of light waves that are reflected from an object onto the emulsion of a light-sensitive film. When the film is developed and then re-exposed to either laser or ordinary white light, it recreates in space *all* the points of light that came from the original object. The resulting image has all the dimensions and details of the original.

To start: one stream of laser light is aimed at a beam splitter, which divides the coherent light into a subject and a reference beam. The subject beam (*beamB*) bounces off a series of reflecting mirrors and completely surrounds the subject of the hologram. Its waves are then directed towards

the film, where an interference pattern is created with the reference beam (*beamA*). This interference pattern carries *all* the light information about the subject.

Holographers depend on an absolutely rock-steady surface in order to make their holograms. The sand table pictured here is an inexpensive solution to this problem. It uses very fine, washed sand, cement, plywood sheets, cinder blocks, and a partially inflated automobile inner tube to provide an adaptable working surface. The most expensive component in the holographic works is the laser light source, which starts at about \$400, depending on the type of hologram to be made. The whole system can be started for around \$2000.

Seeking Extraterrestrial Life

By JOHN BILLINGHAM

John Billingham, Ph.D., is Chief of the Extraterrestrial Biology Division at the NASA/Ames Research Center, and is Director of Project Cyclops.

If you believe that there are other planetary civilizations, what would be the best way to actually detect their existence? We believe it would be to try to pick up signals that they were giving off, in the same way as we are giving off signals from

Earth: TV, radio, radar, and so on. To do this, you have to build a system of radio telescopes which can pick up and detect those signals.

Project Cyclops

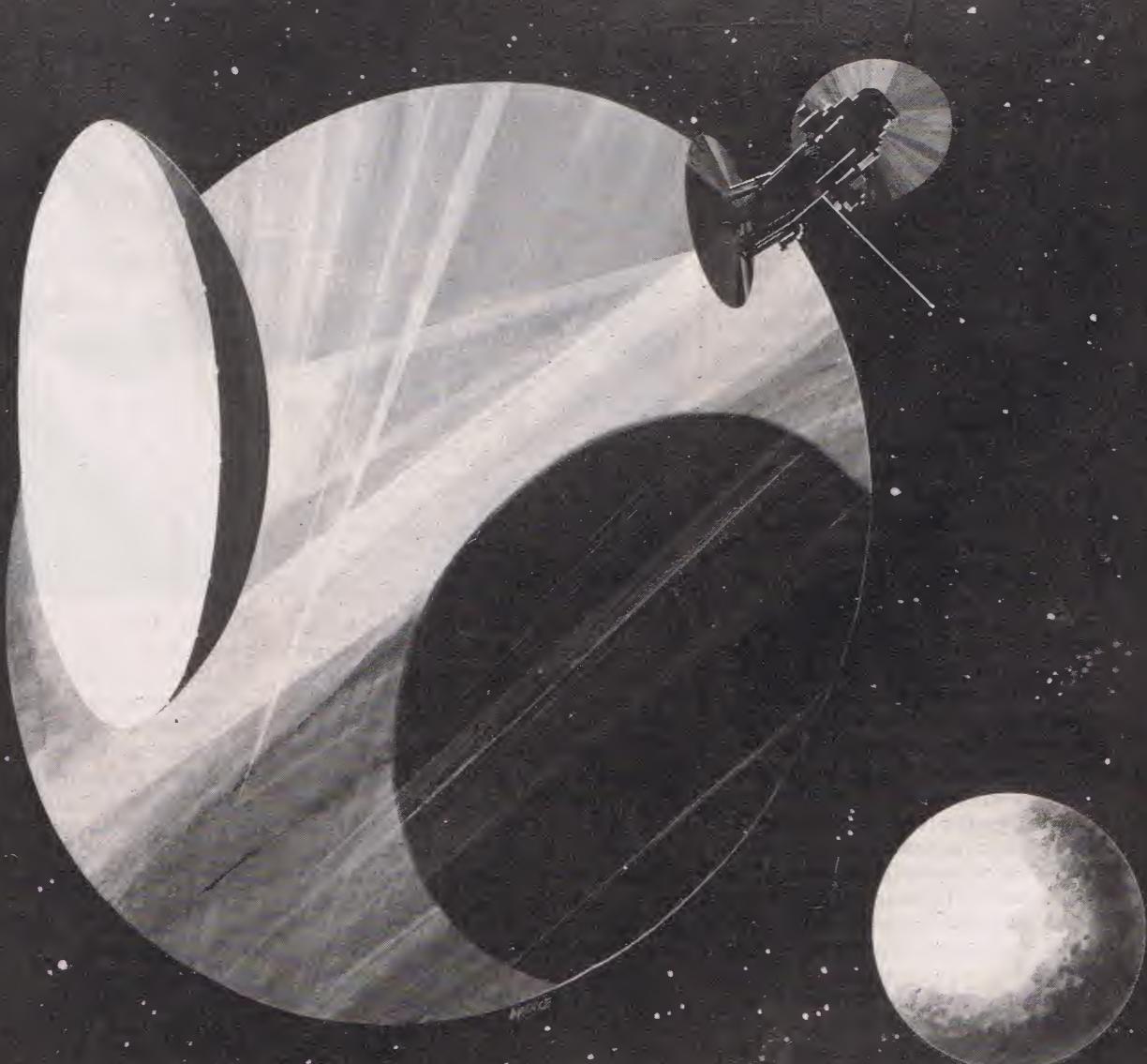
Cyclops, our project concept, is an array, or orchard, of radio telescopes. You can't build one huge one, because it would collapse under its own weight. You have to build lots of them, each one the size of a football field, and then swing them all

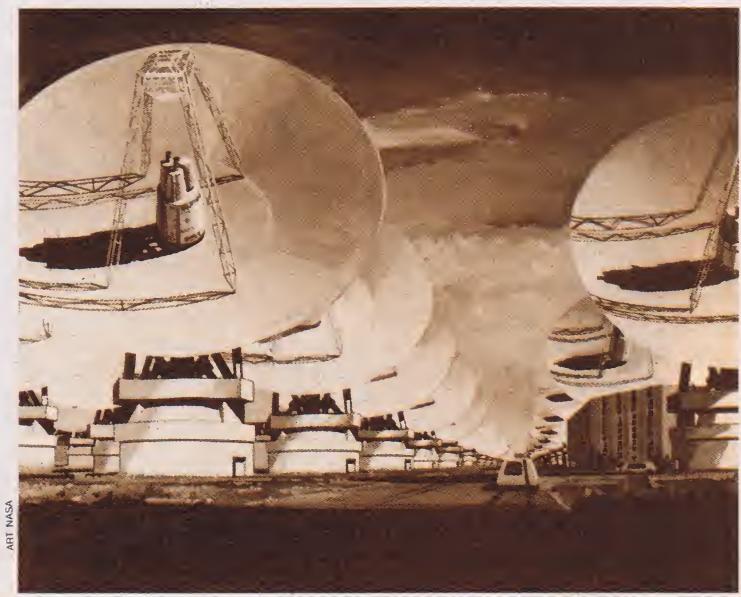
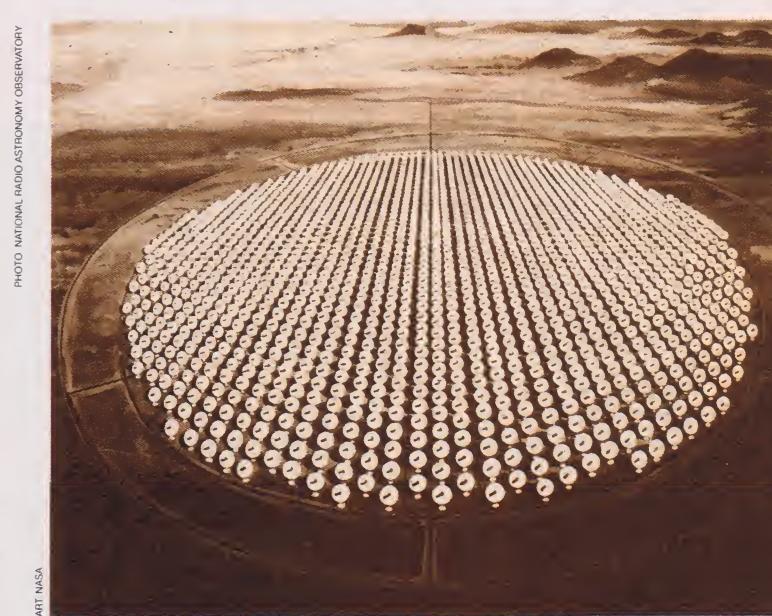
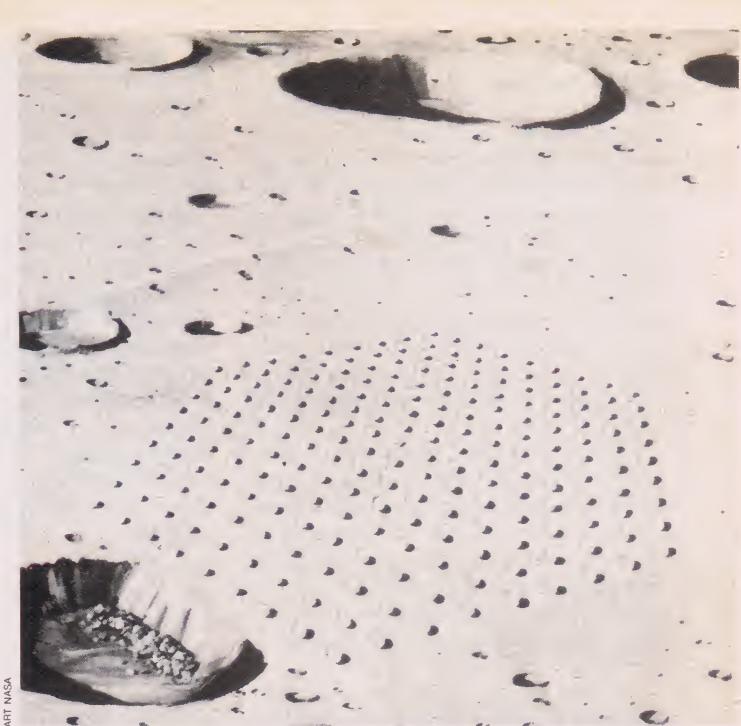
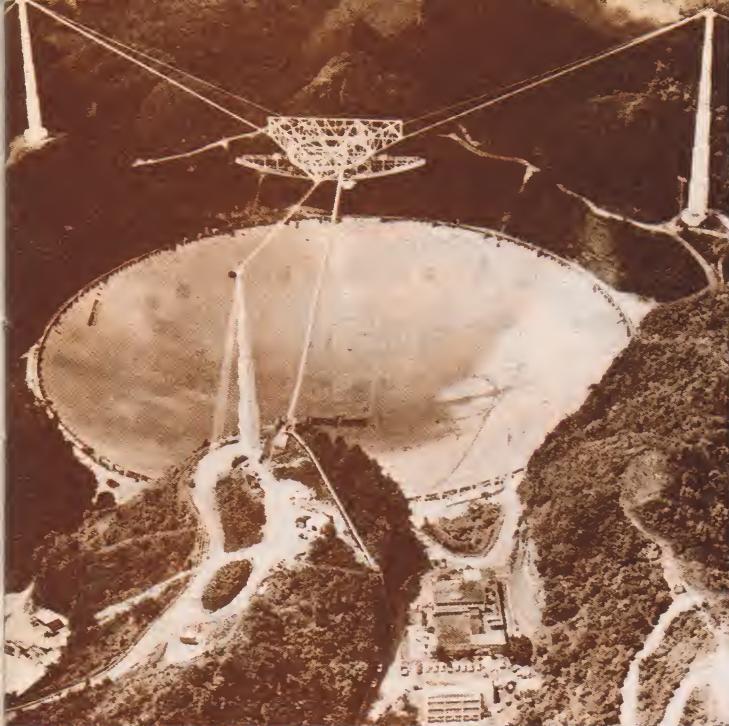
around and point them in the same direction. Then you take all the signals together, and feed them into the data-processing system.

The original concept of Cyclops was to start not with a whole orchard of antennae, but with one. That other civilization might be close; it might be far away and

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Below: Artist's concept of a spherical antenna three kilometers wide positioned in orbit around Earth to listen for extraterrestrial signals. Opposite page, top left: The radio telescope at Arecibo, Puerto Rico. Bottom left: The 85-foot telescope at Green Bank, W. Va., used by Frank Drake to send the Project Ozma message to the stars. Top right: Artist's concept of a SETI antenna system on the surface of the Moon. Right, center: Artist's concept of a Cyclops "orchard" of radio telescopes. Bottom right: Ground level view of a Cyclops system.





signaling with tremendous power; it might even be beaming the signal directly at us. Therefore it is possible, although unlikely, that the signal is already here and is strong. If that is the case, you don't want to spend tremendous amounts of money, time, and energy building that huge orchard of radio telescopes if, in fact, you can do the job with one. What you do, therefore, is to build just one first, connected to a sophisticated data-processing system, and listen with that. Then, if you need to, you build perhaps ten more, which makes it much more sensitive. Then ten more, and so on.

So there is no one Cyclops system. You *might* need as many as a dozen of the Cyclops dishes to detect a signal from another civilization; you might be able to detect it even with dishes that we have right now. Or you might need a very large number, if the signal turned out to be very faint. This makes the Cyclops system necessarily something of variable size.

Let's say we have to develop it to 1,500 antennae, each one the size of a football field; that would be a very large Cyclops system. With that system we could detect Earth from 50 light years away. That is, such a Cyclops system, situated on some other planet 50 light years from Earth, could detect our current radio and radar and aircraft guidance signals—after a lag of 50 years, of course. Within a 50 light year radius of Earth, there are about a thousand solar systems.

At present, with the best radio telescope that exists, our range is only about one light year for Earth-type signals. Since the nearest star system is four light years away, we wouldn't be able to detect anything unless it was broadcasting with a lot more power than we use here, or unless it was some artifact, like an unmanned transmitter aboard some sort of probe.

What Signals Will We Hear?

If we were to conduct a thoroughgoing search for signals emanating from other civilizations, we would look for two different sorts of signals. The first would be signals intended for home consumption on the other planet (or used by inhabitants of the other planet for communicating with their own spacecraft, and so on). The second would be signals which are deliberately beamed with the goal of establishing contact with another civilization. It is conceivable that civilizations in our galaxy are engaged in this sort of project. Of course, we could hypothesize forever without getting anywhere, because the other civilizations would have to be more advanced than ours to be doing this. Therefore we find ourselves in the realm of pure conjecture.

If someone is trying to establish contact with us by sending out messages, these would be sent in a way that was as easy as possible to decode. The senders would do the opposite of what cryptographers do when making codes. It's very easy to construct a language based on fundamental principles which are the same everywhere in

the galaxy: principles of mathematics, physics, and chemistry which we know are the same, because we can look at those other stars and find out their physics and chemistry. Freudenthal at Stanford spent two or three years putting together such a language, based on mathematics, physics, and chemistry entirely; it could very easily be decoded. We think it's more likely that we would detect a deliberately transmitted signal, than it is that we would be able to eavesdrop on another civilization's internal signals. In the first instance, the problem of decoding and understanding the new language, and then beginning to understand the message (which would be the most difficult part), would be quite straightforward—although I would fully expect to be surprised.

Project Ozma

Project Ozma was, I think it's fair to say, the first search ever undertaken for signals from other civilizations out in the galaxy. It was done by Frank Drake, who is a sort of father of the SETI project, an astronomer at Cornell University. This effort was stimulated by an article in the journal *Nature* by Morrison in 1959, which suggested that if people wanted to talk to each other across interstellar distances, it would be best for them to talk on one of the commonest frequencies in the whole spectrum, which is the hydrogen line. Hydrogen is abundant everywhere in the universe; therefore it's a common thing. Why not choose a frequency close to the frequency of the hydrogen atom, about 1400 megaHertz, or megacycles, for communication?

Drake was stimulated by this, and listened for two months with a comparatively small radio telescope at Green Bank in West Virginia, with a very simple data-processing system, to two nearby stars, rather like our own Sun and therefore, perhaps, good candidates. The odds of his finding anything, as he knew, were incredibly small because he could only listen to one frequency, and we don't know what their frequency is going to be. His integrating system was not very powerful; his dish was not very powerful; he didn't do it for very long; he had to listen to nearby stars.

When we did the Cyclops study, we calculated all these probabilities, and one of our goals was to be quite sure that if we went ahead and designed a really comprehensive system, it should be able to listen across a lot of frequencies in a promising region of the spectrum (which turns out to be the low end of the microwave window) and be able to collect the signal in large quantities, which means it has to have a large surface area; so you have to have lots of big dishes, and, of course, a very powerful data processing system which would recognize a very faint signal. In fact, the Cyclops system was just such a system; it's still only a design concept, though. Nobody's built it. But it would be billions of times more sensitive than Ozma.

What Radiotelescopes Exist Now?

There is a Western one in the shape of a Y. They use railroad tracks to move the telescopes, of which there are 27. They are quite small; their total collecting area is equivalent to only one of our large modern radiotelescopes. If you're trying to collect very faint signals which come from civilizations far away, that system (which is considered a very large array) would be a waste. You'd be better off to go and use the big dish at Arecibo, in Puerto Rico, where Frank Drake now does a lot of his work; or the one at Green Bank, or the one at Bonn, Germany, or a few others.

When we refer to a large array, it is not because of the size of the dish, but because of the ground area it covers. The reason for all those different telescopes is to use them in a way that tries to measure the distance between the fringes of the light waves and, therefore, can very accurately detect the *position* of objects in space. This is entirely different from trying to pick up *signals*, for which you need a very sensitive receiver in terms of intensity.

Finding Extraterrestrial Signals

There is a problem in separating out an extraterrestrial signal from something produced in some way on this planet. Much depends on the characteristics of the signal received. Under certain circumstances, we could identify it fairly quickly as being of probable extraterrestrial origin. However, you have to be terribly careful if you are to rule out the possibility it came from an Earth transmitter. We would conduct an exhaustive analysis of the signal to find out if, indeed, it was coming from a local taxicab, or a passing ship, or an airplane; or if, on the other hand, it had such characteristics that it could only be coming from another civilization very far away.

Hoaxes

We shouldn't overlook the possibility of hoaxes. Under circumstances where there's intense interest, some ingenious minds will go to work trying to spoof the system, and will construct a transmitter which produces some sort of signal which, at least initially, might be misinterpreted. In fact, the Soviets, who are very interested in this whole area of extraterrestrial intelligence, and who are probably doing more about it than we are, have twice so far announced the discovery of signals from other civilizations; in each case, it turned out that they had detected a satellite, one of ours. But there may be deliberate hoaxes, as I say, so you have to be extremely careful in your analysis of the signal. I can't help thinking about hoaxes in the area of UFOs. I'm reminded of the fact that some eminent scientists, in the past, have carried out some of the most perfect hoaxes, which have challenged other scientists for many years afterward. The Piltdown Man was dug up in the early twentieth century in

(continued on page 57)

FUTURE LIFE #11, July 1979

"ALIEN" ARRIVES

The filming of a new \$10 million science fiction horror epic proved to be a murderous experience for all... both on and off the screen.

By ED NAHA

Within weeks, 20th Century-Fox will unveil a movie that many feel will be the biggest in their history. A futuristic property that could, conceivably, top *Star Wars* in box office profits. The movie is *Alien*, a ten million dollar science fiction/horror extravaganza.

Surrounded by studio-imposed secrecy, the production has been described as everything from a "standard cat and mouse" thriller to a "spacefaring *Psycho*." No one connected with the film is eager to go into details and with good reason.

"It's just not the kind of film that should be blabbed about," says one of the film's two creators, Dan O'Bannon. O'Bannon, famous for his SF cult film *Dark Star*, conceived the film's script and story with crony Ronald Shusett. Although *Alien* was essentially his idea, he isn't yet ready to talk at length about it.



PHOTO - 1979 20TH CENTURY FOX FILM CORP

"I guess I could hint a little bit," he smiles when pressed. "Steven Spielberg wanted to show us that, if there are life forces and energies out there in the stars, they may be helpful. They may be childlike and bring us hope. That's a good, positive message. But, with *Alien*, I wanted to make the pulse beat a little faster. What's up on the screen is the reverse of *Close Encounters*."

Basically, O'Bannon's title creature is the stowaway type, one who throttles humans as opposed to thrilling them. The storyline recounts the exploits of five men and two women aboard the futuristic space freighter *Nostromo*. On their way back from a routine mission in deep space, the crew is awakened from hypersleep by their computer, "Mother." A distress signal has been picked up on a deserted planet. The *Nostromo* follows the signal and lands. The crew finds the skeletal remains of a large alien being. Unbeknownst to them, the signal picked up was not one of distress but one of warning. A warning of an alien presence that is the ultimate horror. The seven humans reboard their ship, unwittingly taking aboard *Alien*: a tiny creature who seeks to grow and reproduce in their midst; whose very existence spells death for any unwary human.

Veronica Cartwright, one of the film's stars, embellishes. "When we bring this thing on board, it's tiny and kind of cute," she says. "Then it starts growing and, literally, hanging around. At that point, the whole trip is cat vs. mouse, it vs. us." She pauses a moment. "I wonder how many people are going to be able to sit through this?"

O'Bannon chuckles upon hearing the ac-



tress' comment. "It's not a religious movie," he laughs. "But if you can imagine the devil himself from outer space up on the screen . . . you got 'em."

A Scare is Born

It's totally fitting that O'Bannon refers to his star creation as a "devil" in that, from all accounts, *Alien* was sheer hell to realize.

Hell to write.

Hell to film.

Hell to act in.

"It was really a labor of love," O'Bannon admits. "The idea for the movie goes back to 1972 when I wrote the first half of it. It was untitled at that time. I was working on *Dark Star* and I thought of doing a

similar film but without the humor. A really scary movie."

Ron Shusett, O'Bannon's energetic accomplice, picks up the thread. "Dan and I worked on one film script together called *They Bite*. It came out so well that a studio optioned it. At that point, Dan went off to work on the special effects for the movie version of *Dune* in Europe."

"What a fiasco," O'Bannon marvels. "That fell through within six months. I wound up staying at Ronnie's house. Ronnie had always aspired to be a producer and I had always aspired to be a director. When I walked through his front door, I had tears in my eyes. I had never been lower. He's standing there smiling. 'Dan,' he said,

PHOTO © 1979 20TH CENTURY FOX FILM CORP.





"I came up with zero and went to bed. Now, at that time, Dan was sleeping on my couch. He had counted on living off his *Dune* money which never materialized. He was broke and so was I. Nobody bit on *They Bite*. My wife was supporting both of us. I went to sleep and woke up suddenly with one sentence in my head. I can't tell you the sentence because it would give away the crux of the film. But I figured out how the creature would make contact with his first human. I ran in and told Dan and we started typing that night."

Within weeks a finished story and screenplay were completed. The twosome then called upon artist Ron Cobb to illustrate the script with a series of drawings. Cobb, who had met O'Bannon in the 60s, was an editorial cartoonist with a flair for SF fantasy. He designed the exterior spaceship portions of *Dark Star* and saw *Alien* as another chance to send his pen to space.

"I did a batch of paintings in a vein that was almost 'Son of *Dark Star*,'" Ron remembers. "The movie, at that time, was intended to be rather modest. I guess you could say cheap. A small ship. A small temple. A small planet. These paintings were circulated with the script. Once it was sold, they dragged me along with it. I always believed *Alien* was going to be a good film . . . I never dreamed it would be a good 10 million dollar film."

Through a partnership deal with Brandywine Productions (Gordon Carroll, David Giler and Walter Hill), *Alien* was bought by 20th Century-Fox . . . and, at that point, growing pains hit the beastie hard.

"Dan and I wrote this as a low budget film," Shusett admits. "We thought we could do it for \$650,000. But we always

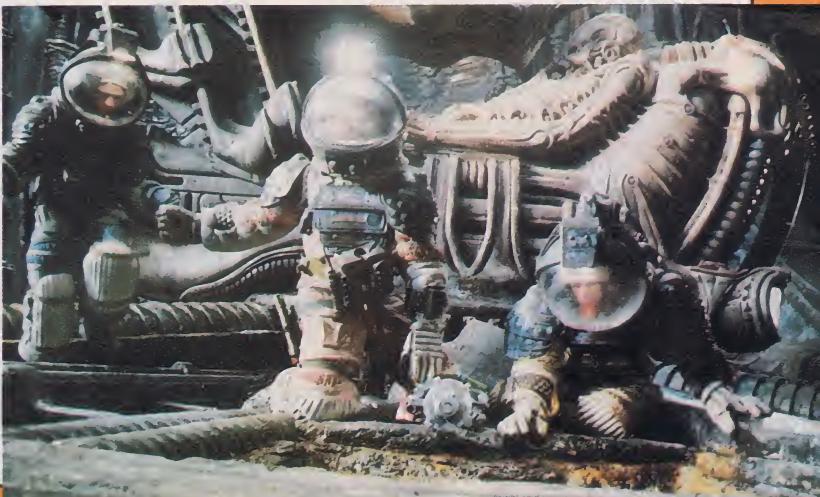
Opposite Page: The Earth technology aboard the *Nostromo* was largely conceived by Ron Cobb. Left: On a barren, alien landscape, a human landing party investigates the remains of a deserted alien ship. Both the ship and the terrain were designed by artist H. R. Giger who combines metallic and organic imagery for a startling effect. Below: The humans stand before the remains of a dead pilot-creature.

"we're going to do great things together.'

"I looked at him like he was crazy. 'What do you mean? Things couldn't be worse.' He told me that he had just talked to a priest. 'The priest told me that my career is about to soar. Lightning is about to strike. Now that I see you walk through the door, I know that we're going to do something great together.' I thought he was nuts, of course. But it turned out to be true."

"We were working on some other projects," says Ron, "when Dan brought out *Alien*. I didn't have any ideas to contribute. We both floundered around. Dan said, 'Ron, if you'd just put on your thinking cap, I'm sure we can turn this into a hot property.'

PHOTO: © 1979 20TH CENTURY FOX FILM CORP





Above: Aboard the *Nostromo* are unsuspecting crewmembers Dallas (Tom Skerritt), Ripley (Sigourney Weaver), Lambert (Veronica Cartwright), Brett (Harry Dean Stanton), Kane (John Hurt), Ash (Ian Holm) and Parker (Yaphet Kotto). **Below:** Ripley, Parker and Brett in search of the alien... a creature whose very existence means death to any and all humans in the vicinity.

believed in it and thought it could make our careers. We thought it could be an effective super-sleeper, scaring audiences within a confined visual framework. When Fox got involved in it and the big name people like Gordon Carroll (who produced *Cool Hand Luke*) got excited, they saw it as a high

budgeted film immediately. So, Dan and I watched this little movie premise, which we wrote together when we were starving, mushroom to this multi-million dollar epic. We almost died."

At this stage of the game, *Alien* was traumatizing quite a few people, including

Brandywine's Walter Hill, who recounts, "We faced many challenges back then. I think our greatest challenge was taking the project seriously... in the sense that, in the end, it is a rather silly story. It's a very simple tale. Now, by having to take it seriously, I mean we had to get a group of motion picture people to see that it was intended as a serious and intelligent motion picture. The project was basically the kind of thing that they used to make back in the 50s starring an orange blob or something. The idea that we should persuade financiers to invest \$10 million in this was a *real* challenge. But once everyone saw what we were trying to do, we all pulled together in one direction."

Almost.

Within the months of pre-production planning, dreams rose and fell like ruptured rocket ships. O'Bannon, who had hoped to direct the film himself, was nudged out in favor of Walter Hill. The screenplay by O'Bannon and Shusett was given a reworking by Hill and Giler (the amount of work done is still a point of contention). Tempers flared. Work was done, undone and redone.

Yet, somehow, in between bursts of low-keyed antagonism, *Alien* progressed.



"They spent some seven months expanding my original designs," explains Ron Cobb, "because Gordon Carroll immediately saw it as a bigger film than Dan had intended. They brought in artist Chris Foss and Chris and I were stuck in a little office at Fox for over half a year, expanding upon these designs."

At this point, Walter Hill bowed out as director and Britisher Ridley Scott entered the picture. Scott, best known for his work on the costume adventure *The Duelists*, was instantly captivated by the script. "It took me 40 minutes to read it," he states. "It usually takes me about four days. To me, it's more than a horror film. It's a film about terror!"

Scott flew from England to L.A. to supervise the design. Says Cobb: "He liked a lot of the original designs and what they represented. They didn't like too many of Chris' ideas but they enjoyed most of mine. They asked me to stay on for the production. So I flew to the studios in England and started the whole design process over again. This time I was re-redesigning things with Ridley. Then, artist H.R. Giger was brought in from Switzerland to do the alien designs. I was given the Earth technology. I worked continuously for the next six months."

Meanwhile, back in the states, gears were turning at 20th. "I think that the only person at 20th who really believed in this from the beginning was Alan Ladd," says O'Bannon. "The rest of the folks were split down the middle until the project started picking up speed. It didn't take long for them to get into it, though. Generally, people don't believe in things until they can see them. With *Alien*, Fox was internally calling it their most important upcoming picture since late 1977, almost a year before we started shooting. That was quite a reputation to live up to."

Both Shusett and O'Bannon frankly acknowledge that, at times, during *Alien's* embryonic days, they were terrified at the thought of mounting such a massive project. The ever-optimistic Shusett, however, simply chose to ignore his negative feelings, concentrating on the more magical side of things. "When you think of it, the whole experience is amazing," he bubbles. "Ron Cobb had never worked on a major film. Giger had never worked on a film. Dan had done only one picture. I had done none. Ridley Scott had only made one theatrical movie in his life. He was mainly known for his TV commercials. And there we were, with a ten million dollar film that people were saying could be bigger than *Star Wars*! We were all in our thirties and inexperienced. What a crazy feeling."

And craziness, in all its forms, was the code name for the *Alien* set.

Designing the Impossible

"Being on the set was not easy for anybody," Dan O'Bannon says grimly. "It

was tougher than hell on everybody. It was hard. Hard. Hard. There were constant arguments. Disagreements. This picture had good guys involved with it and bad guys involved with it. It was hard on all of them."

One of the biggest stumbling blocks in getting *Alien* before the cameras was its design. In essence, nothing in the movie could be *real*... a gigantic problem for the film's designers and technicians. "The picture," marvels Ron Cobb, "is *designed* from beginning to end. It's one big effect. There are no natural settings. We didn't even use locales. We had rocket interiors built on sound stages. Even all the alien planet scenes are on sets constructed from Giger's design.

"I'm just really happy that I had so much input in the design of the movie. I had a free reign with the Earth technology aboard the *Nostromo* because there were very few people on the project who had any thoughts on this area. I jumped right into it. I thought that the spaceship should be depicted in a fairly naturalistic way. Ridley and a lot of other people wanted to go much more heavily into fantasy. The finished effect is a mixture. The spaceship is sort of a cross between an art deco dance hall and a World War II bomber. It works on the screen, though. Ridley welded it all together with a soft, romantic light."

With the Earth ship designed, the production team went on to an even more monumental task: designing the alien creature itself. The thing, which metamorphoses into several stages of existence during the film, is the work of European artist H.R. Giger. The finished creature is, on orders from the front office, a forbidden

subject to talk to reporters about. When asked for a description of his alien creation, Giger just shrugs his shoulders and comments, "It lives to kill and kills to live."

Brandywine's Walter Hill explains the reason for the secrecy. "The alien should be a surprise," he states. "Everyone worked so hard on it. We worried enormously about realizing this alien presence on the screen. It's one of the great triumphs of the movie. When you make a movie like this you can, through very sophisticated film techniques (quick cuts and reaction shots), build a lot of tension. At some point, though, and this is where a film of this type usually gets in trouble, you have to show the audience what it is that's causing the tension. Unfortunately, we were all raised on the celluloid tradition of cutting to an enlarged grasshopper or a sponge with a mouth or a preying mantis as big as a cardboard Empire State Building. In *Alien*, when you actually see what is causing the terror, you see something that is formidable and believable. No audience will be disappointed."

Shusett agrees. "Giger's involvement alone makes this movie at least 20 percent better than it would have been. Never has there been a film monster as frightening."

The adult alien, an actor encased in a massive costume with added mechanical embellishments, impressed everyone, including the actors being pursued by the beast. Says Veronica Cartwright, "Giger, the fellow who designed this thing, is almost as surreal as the monster. When he made his alien, which is a combination of many horror elements, he made it absolutely exquisite. It's very macabre but it's very beautiful. You don't know quite how to take it. In one sense, it's grotesquely ugly. Yet, it's

Veronica Cartwright (below) plays ship's navigator Lambert, the crewmember who unwittingly guides her peers to the unknown planet where the *Alien* makes first contact.



beautiful. Remember all those stories about how the actors in *Close Encounters* wanted to play with the mechanical alien because it was so pretty? Well, with our creature, you want to look at it for a few seconds but you definitely don't want to touch it."

With the human rocketship, the alien and the duned alien landscape designed, the film crew then gave the alien spaceship to Giger to conceive. On paper, it defied description. On the screen, thanks to the talented artists, it also boggles the mind. "He did the entire ship organically," Shusett states. "We wanted it to look like it was built by something other than human, built by a totally alien intelligence."

The finished derelict ship, an eerie melding of the mechanical and biological, was completed in record time and, in the summer of '78, shooting began in England on *Alien*. Filming was to last four months, two dozen major arguments and an infinite number of bruised egos.

The Making of "Alien"

"As much as I love the movie," Ron Cobb smiles, "I have to say that most of this movie was pretty grim, hard work. Everybody sweated this one out."

A good deal of sweat arose from the very concept of the film; its total unreality. The problems in making the film were just as psychological as they were physical. Not only were the cast and crew making a movie *about* an alien, they were surrounded by a totally alien terrain. The look of the sets, the length of the shooting, the flow of the script all caused a great deal of confusion and frustration.

"The actors were quite lost at first," Ron Cobb recounts. "As was Ridley. No one on the film was quite sure how things should be done. There was a lot of confusion about what approach should be taken. There was a lot of inexperience concerning futuristic films. Ridley and Gordon Carroll had never made a movie of this sort before and most of the production designers hadn't either. I think Giger, Dan, Ronnie and I were the only guys that felt at home on this weirded-out set. And we had no experience in film-making, really."

"So we kept on yammering away, yammering away, trying to get people to steer away from science fiction ideas that had already been done before on the screen but that these people didn't know about because they hadn't seen the old films. We had to give them a sort of subtle cram-course of fantastic cinema to lead them up to something really original."

As frustrating as the overall concept was to the production team, the script proved more so to the actors. "They were pretty out of it at first," Cobb admits. "The film's characters were only sketched out in the screenplay. Dan and Ron didn't really spend a lot of time putting a great deal of depth into the characters. It was a very straight, linear type of horror story. Eventually, the actors wound up supplying the

depth because they felt so uncomfortable saying these lean, empty lines. As the film progressed, the actors all began to invent, to fill in their characters. By the time they had progressed a little bit, they had put considerable substance into their portrayals, especially John Hurt and Ian Holm. Harry Dean Stanton and Yaphet Kotto turned their pairing in the engine room into a sort of comedy team. It's very interesting how everyone brought the script to life."

But acting in *Alien* was no easy task, even for the most experienced SF veteran. Veronica Cartwright, the star of last year's *Invasion of the Body Snatchers*, found the going tough from the outset. "To be honest," she says, "when I first read the script, I wasn't going to do the movie. Then I talked to Ridley and heard that Yaphet and Tom Skerritt were going to be in it. I respect their work a lot. I thought to myself, 'well, if these people are going to do it, it must be worthwhile.'

"But we still thought the script was pretty outrageous. So, Ridley sat down and explained to us, in very concrete terms, what this alien was like. He couched everything in experiences and feelings we could relate to. He made our whole situation as real as possible. He explained to us that there's a certain type of beetle that has a similar parasite/host relationship as the alien does with humans. He wanted his alien to mimic nature. We, in turn, were to react to it as nature on a large scale."

Even as the actors warmed to their roles, other tensions were brewing. "The picture wound up being a whole lot bigger than anyone had anticipated," Cartwright continues. "So there was a heck of a lot more pressure coming down on us. The film company had locked us into a release schedule so we were working on a strict deadline. I mean, we'd be acting on some traumatic scene and there'd be studio executives on the set. De-pres-sion."

"The tensest day was the first day of shooting," O'Bannon injects. "The sets weren't even finished. Poor Ridley was shooting on half a set. Plus, all the executives from Fox were on the set. They were concerned with the project running over schedule. They all flew over to London and, on that first day, they were all standing there, wordlessly staring at Ridley. Dead silence. It was like a library in there. The tension almost made my spine crack. In between takes, the carpenters would continue building the sets."

"It's hard to pinpoint the roughest day because there were so many of them. I left the set last fall, before the film was completed. It was just too exhausting. I had been on the picture, at that point, for over a year. I had gone through every argument conceivable every step of the way. There were a lot of wonderful people who cared an awfully lot about the film and were all fighting with each other all the way through. By the time we got to the actual shooting, I was suffering from nervous ex-

haustion. It finally reached a point where I didn't think I could contribute anything more. I left. I went home. I was, in essence, a total wreck."

Even O'Bannon's cheerful cohort Ron Shusett acknowledges that, "It wasn't the most relaxed set in the world, with tension created by both the alien and the studio." But, he adds, "The studio, by and large, cooperated marvelously. They were worried, not about money but about time. They pressured us but they were behind us creatively. We were over budget and they were still spending more money on us, building us new sets because they'd look good on screen. One of Fox's British executives, Peter Beale, stood behind the camera an entire day to make sure we got out of one studio facility on time. When we didn't get the take we wanted, he stuck his own neck on the line and gave us an extra day. He cared about the movie. He was under pressure, too. Everyone was a wreck."

Possibly the most obvious wrecks were the cast members. Surrounded by other-worldly effects, dwarfed by a randy alien monster and in the middle of a corporate battle of nerves, they began to identify with their stranded script counterparts, their characters' dehumanization. "Sometimes it would take hours to set up a scene for the benefit of the alien," moans Cartwright. "After a time, you begin to feel that you're being left out of the film as an actress. So much time is spent on effects, worrying about whether this or that is going to work out so the audience will believe it. The special effects have to be believed by the audience or else the movie won't work. So, on one hand, you realize that these set-ups are necessary, but on the other hand, as a human, you suffer from a bruised ego. There was just so much pressure being applied on everybody that it was not a particularly happy picture."

Yet another thorn in the actors' sides were the sets themselves, totally surreal backdrops that, somehow, they had to seem comfortable in. "In their own strange way, the sets were an incredible benefit," Ron Shusett states. "They totally threw the actors off balance. Tom Skerritt told me one day: 'I have a hard time keeping myself from walking around this spaceship with my mouth hanging open all the time. I'm supposed to have been on this ship for ten years and I shouldn't be amazed by it. I have to come here at nights to just sit around and get used to it. It's really that unnerving.'

"The rocketship worked out well," Shusett continues. "It was built in a manner almost totally unheard of for a movie set. It wasn't built with cutaway walls and different areas of the rooms done up in separate, scattered sets. The ship was built as if it was a ship. It was a unit. The *Nostromo* had tunnels and hallways. You had to walk through the whole thing from one

(continued on page 66)

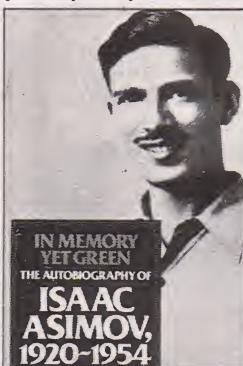
Asimovia and Beyond

Asimov avalanche

Since his first story appeared in *Amazing* 40 years ago, Isaac Asimov has been churning out books at the prodigious rate of one every 12 weeks. For his 200th effort, *In Memory Yet Green* (Doubleday, \$15.95 in hard cover), Asimov tells us all about himself. An autobiographical dissection of the good doctor's life from 1920 to 1954, this is no nostalgic trip to yesteryear—just the facts, and lots of them, in a style reminiscent of the longest *Dragnet* episode in history.

As Asimov notes, he remembers places and events much better than people, so he regales us with such notable events as his first pizza and a trip to the podiatrist. His more sensational tales include encounters with such celebrities as super-editor John W. Campbell and his first intimate episode with a female SF groupie.

While this attention to trivia may madden the reader, *In Memory* chronicles a journey fully as stunning as any of his



heroes' excursions to the stars. Asimov's childhood is grim. He grows up a functional orphan because the family candy store—"a prison"—forces his parents to work, sleep, eat and raise the children in shifts. Touching family scenes around the dinner table are nonexistent. And young Isaac, though a brilliant student and hard worker, can never completely satisfy his parents. He admits that their fears about his future and well-being were so extreme that he couldn't help but absorb them, and that insecurity produces a grotesquely loud young man almost incapable of making a good first impression.

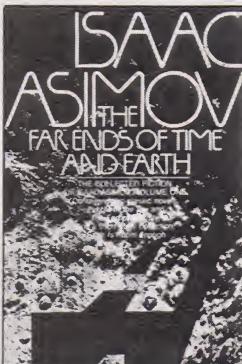
It's astonishing that although everything from airplanes (he refuses to fly) to apartment hunting unnerves him, Asimov is able to create a paper avalanche between anxiety attacks. The reason for this phenomenon may be that he's totally relaxed and confident about his writing. When he begins talking about his books, all anxiety disappears. A hapless, pimpled 18-year-old when he meets John W. Campbell, Asimov listens and quickly learns how to tailor a story to a particular editor or market, how

to rewrite and, most important in those days, how to get paid before the magazine dies. Hidden among the trivia of his early writing days are important lessons in how to make a living as a professional writer, if not how to write.

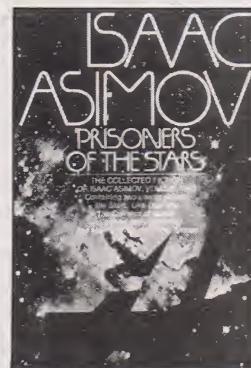
By his 21st birthday, Asimov is earning \$1,000 a year and has already published his classic story, *Nightfall* (once voted the best SF story ever). When this volume ends, he is 34 and writing is second nature. He has eight books to his credit, a PhD in chemistry and has had his driver's license for four years. Even with his new confidence, Asimov still works ten hours a day, seven days a week at his typewriter—he can never stop without hearing his father's voice calling him a shirker.

A second volume bringing us up to date on this phenomenal performer is promised for later this year, posing the question—can we finish Asimov's autobiographies before his 300th book comes around?

There are two sides to the history of Dr. Asimov—his life and his stories. Now that he's catching us up on the former, his publisher is presenting us with the latter. Doubleday is planning a series of uniform omnibus editions containing all the good doctor's science fiction and mysteries, called *The Collected Fiction of Isaac Asimov*.



The first volume of this massive endeavor, *The Far Ends of Time and Earth* (Doubleday, \$12.95 in hardcover), contains three long out-of-print (in hardcover, at least) leaps into the future of our home planet. The opening novel is *Pebble in the Sky*, Asimov's first published book, which tells the story of an Earth of the far distant future ravaged by nuclear war and forgotten by its colonies. It's followed by *Earth Is Room Enough*, a collection of mid-'50s short stories set in all of Earth's possible times, and a second novel, *The End of Eternity*. This less-than-blinding tale of time travel is notable chiefly in that it honors the legendary (and loving) Asimov/Ellison feud by having a hero named Harlan.



The second selection in this literary landslide is *Prisoners of the Stars* (Doubleday, \$12.95) and it gathers six fabulous fantasies and a new introduction by Asimov. Dr. Asimov's second published novel, *The Stars, Like Dust*, opens this volume. It follows a young man through a classic science fiction change-of-life: One day he's a student at the University of Earth and the next he's a fugitive fleeing an unknown assassin into the inky darkness of the Horsehead Nebula. There the hero and a beautiful girl have a final showdown with their ruthless opponents. *The Currents of Space* is another novel of interstellar intrigue and, similar to *The Stars, Like Dust*, is set during the rise of the First Galactic Empire, Asimov's celebrated Foundation Trilogy world-set. Both novels are outstanding examples of early Asimov adventure stories that still deliver the requisite thrill a minute. *The Martian Way and Other Stories*, a collection from the early '50s featuring some of Asimov's unique extraterrestrials in action outside the galaxy, completes this volume. Though these aliens may seem run-of-the-mill today, in the '50s aliens were supposed to be wiped out—never peacefully lived with, as Asimov proposes.

These two volumes are compelling evidence of Dr. Asimov's expertise, showing that sheer volume isn't the only reason for his literary longevity.

Martians? Maybe...

TV and SF writers never have a problem with the question of life on other planets. They just give Spock two minutes with a tricorder and he gives them the answer. So when the two Viking Landers touched down on Mars, some of us expected them to swallow a bite of soil and proclaim "It's alive," or more conventionally, "It's dead, Jim." Sadly, detection of alien life isn't yet that simple or certain.

Mars has tantalized people for centuries and today, despite hundreds of close-up pictures and dozens of tests by the Viking Landers, the only thing we can be sure of is that we still aren't certain if anybody's there.

In *Life on Mars* (Dutton, \$9.95 in hardcover), David Chandler begins to describe life on Mars by explaining in vivid detail how life began on our own planet. He demonstrates that life is almost inevitable if there is time and the right environment. Then he makes the jump to Mars to show us evidence that the proper environment for some kinds of life may be there now or have been there in the past.

Using a winning combination of speculation and science he prepares us (actually makes us impatient) for the only thing that can finally determine if there is life on Mars—a human expedition to the red planet. And there are some incredible sights waiting for those first explorers—fog-filled canyons, giant volcanoes and the mysterious pyramids of Elysiums. These eerie tetrahedrons dwarf any man-made structure on Earth. Half a mile high and wide enough to straddle Manhattan, they sit on the plains of Mars defying us to explain them away as natural phenomena.

While he isn't yet ready to introduce us to his favorite Martian, Chandler does sound like the first extraterrestrial real estate agent when he touts Mars as the most pleasant place we've found away from our own planet.

Romantic Dance

One of NASA's greatest hits is its film of astronauts cavorting in Skylab. Their antics convinced many people that the possibility of flying free of gravity's pull is reason enough to want to go into space. Escaping gravity's pull is the reason the Stardancers had

to go into space, in *Spider and Jeanne Robinson's Stardance* (Quantum Science Fiction/The Dial Press, \$9.95 in hardcover).



Gravity is Shara Drummond's greatest enemy. A genius obsessed with dance, her too obvious feminine endowments barred her from the androgynous world of professional dance. There's no way for her to dance—no way on Earth. She makes her way to Skyfac, the orbital manufacturing facility, and there creates a new art—zero-g dance. It is a revelation to the earthbound millions and turns out to be the only way to communicate with a menacing swarm of bizarre aliens who dance in from deep space. Tragically, Shara doesn't survive Stardance, for as the aliens flee, she dives

flaming into the atmosphere.

But Charlie Armstead, who filmed and loved Shara, is determined that her art will survive. With Norrie, Shara's sister, and an eclectic crew, he forms the Stardance troupe. This wild bunch dances again before those same aliens, but this time the dancers are offered a hand up the evolutionary ladder instead of despair and death.

The first part of this evolutionary fairy tale was published as a novella last year and swept both the Nebula and Hugo awards. And while it seemed impossible that they could maintain the same quality, Spider Robinson and his dancer/choreographer partner, Jeanne, have teamed up to create a finale grand enough to repeat last year's sweep. It's a well-told story full of characters you are forced to care about. And though the cavalry may arrive one or two times too many, the Robinsons have fashioned a story sure to be as popular as it is romantic.

British Vision

The Very Slow Time Machine (Ace, \$1.75 in paperback) is the first American collection of bright new British star Ian Watson's short fiction. Since he served his apprenticeship in British magazines and collections, readers on this side of the Atlantic haven't been able to watch him develop the brilliantly crafted style that marked his debut novel, *The Embedding*.

Where American SF writers have often been hard-pressed to include anyone but muscular Caucasian young men in their future scenarios, Watson seems to delight in telling tales of such disparate types as an Afrikaaner at the end of the world, a Japanese lady who is the art of the future, and an Arab sexual psychic in love with the heart of a quantum black hole.

The range of Watson's interest and ideas is breathtaking. He is fully prepared to play with mystic physics or wonder what the unused portions of our brains are up to while we're asleep. One of his characters sums up this collection when he says off-handedly, "Certainly I've let my imagination run riot...that's why it's true." This collection is certain to recruit many new readers for Watson's brand of quiet apocalypse.



Books in Brief

To The Red Planet by Eric Burgess (\$19.95 in hardcover from Columbia University Press). Mars. The Red Planet. For years, the Valhalla of science fiction writers and fans alike, the pot of gold at the end of a mysterious rainbow. Edgar Rice Burroughs stocked it with multi-limbed green giants. H.G. Wells populated it with lethal, tendrilled menaces. In 1975, the U.S. launched its first Viking spacecraft on a mission to seek out Martian life and to explore the enigmatic planet. Science writer Eric Burgess manages to trace the history, the adventure and the accomplishments of the Viking expedition to Mars in clear, concise prose that will entrance both the science buff and the science fiction fan. Beginning with a short essay on humanity's constant fascination with Mars, Burgess introduces his readers to the people behind the plan, the scientists and workers who actually mapped out the Viking strategy. *To The Red Planet* effectively recreates the tragedies and triumphs of the Martian landings: the experiments that mystified the scientific community, the mechanical malfunctions that kept the world on the edge of its collective seat, the majestic pictorial panoramas that graced the front pages of every newspaper in the free world and the data that revealed the history of the planet's physical makeup. If there is fault to be found in this book it lies in the constant use of black and white photos. Dramatic though they may be, seeing the Viking's pictorial survey in all its scarlet glory would have made the day of even the most stubbornly green-minded Edgar Rice Burroughs fan.

(Charles Bogle)

Opus 200 by Isaac Asimov (\$10.00 from Houghton Mifflin in hardcover). Caught up in the current wave of Asimovmania sweeping the science fiction community is *Opus 200*, an unpretentious little volume of work that could serve as an introductory guide to Isaac Asimov. Sort of an Asimov sampler, *Opus 200* presents a series of glimpses of Asimov's work in both science fiction and science fact. The book, divided into 15 subject headings, gives the reader a chance to see the ever-toiling author delve into such areas as astronomy, mathematics, the Bible, humor, social science and mystery. Not exactly the sort of book that will keep you riveted to the page, *Opus 200* does manage to conjure up a fairly revealing insight into Asimov's constantly kinetic literary personality. In short: when you're interested in something, write about it. Also included in the volume is an appendix listing the second hundred books of Isaac Asimov.

(Joseph Kay)

GALLERY

Scott Thom

Scott Thom is an artist with a limitless supply of ideas. Where does he get the inspiration for all his glowing UFOs and ethereal landscapes not of this Earth?

"I believe there is a river that spiritually and thoughtfully proceeds through the universe, through *all* the universes," says the southern California artist. "I believe there are other intelligent beings who perceive things, and that whenever anything, anywhere, is perceived, it goes into that river. It is like a cosmic consciousness. The river is consciously transmitted through space, receivable by anyone who wants to receive. I think I can tap into it. Things go into my imagination and are transmuted by my mind's eye, then recreated into two-dimensional space."

"I suppose the computer banks of my memory contribute something," Thom smiles easily, "but some of the more far-out scenes I paint, like places with two moons, I feel are more meaningful."

The Gallery centerspread, "Midnight in Puerto Vallarta," isn't some alien landscape Thom received through the space river of consciousness, but a result of astral projection. He had to stay home one weekend when friends



went down to the Mexican seaside town of Puerto Vallarta. "I wanted to go real bad," Thom recalls, "and while they were there, I got the idea for this painting. I really think I 'went' down there, in some sense."

Scott Thom says he started drawing "as soon as I was old enough to hold a pencil" and earned a college degree in graphic design in 1973. In 1973 he discovered two important influences: hang-gliding and the airbrush. He formed a hang-gliding company with three others and became a sky instructor. "I spent a lot of time in the sky," he says, "and while I was up there I noticed that clouds

look airbrushed."

He bought an airbrush and started doing clouds. These days he says his time is divided about 50-50 between advertising art and commissioned works, and just painting what he wants to paint. He painted the poster for UFO theorist and lecturer Dr. Jacques Vallee (FUTURE #8, Databank), and recently the cover of Vallee's latest book, *Messengers of Deception* (And/Or Press). Another Thom UFO graces the cover of a book titled *The Contact*, written by Clint Carry, "better known as the Spaceman of Ocean Beach."

Producer's Circle recently bought rights to several of the

artist's unpublished works, including the two featured here, to be used in an outdoor laser space music extravaganza in Japan. Thom also did the spacey artwork for futurist Barbara Marx Hubbard's "Theater of the Future," a philosophic multimedia show now touring the country. Another recent painting is for the cover of sound artist Bob Walter's album, *Time Warp/A Zado Myth*.

"I like to do things with science fiction and science," Thom says. On this page is an example of pure science fiction art. According to the artist, the craft in the foreground has just attacked the planet in the background. The second craft is in hot pursuit.

These days, 31-year-old Thom has given up hang-gliding and taken up sailing. "When I'm on the ocean, my mind is in the sky as much as it was when I was hang-gliding," he says. His goals for the moment are to "become much more prolific and to improve my mind's eye."

He still loves to paint clouds and "doing anything with light, space and the future."

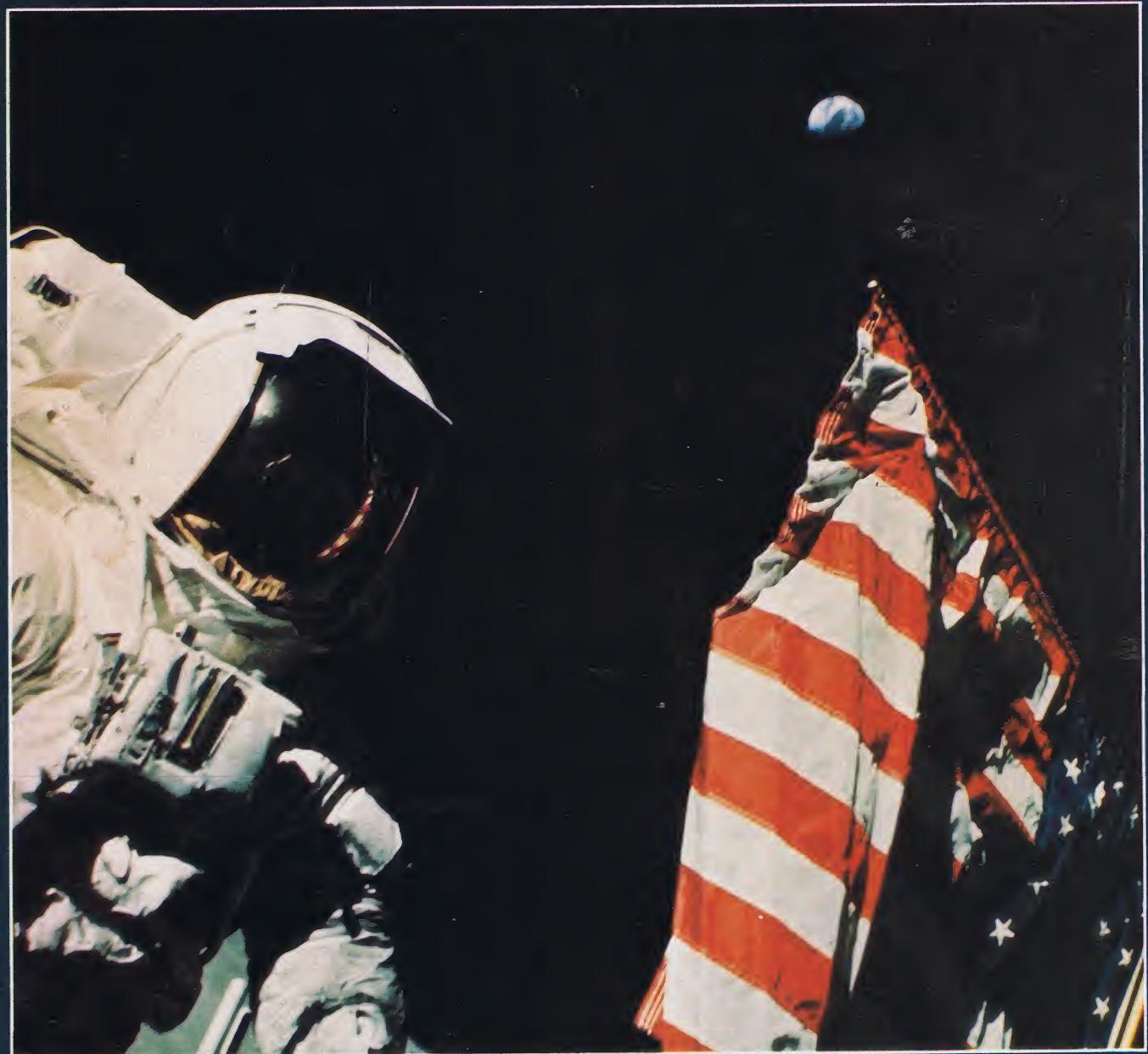
"I have no interest in the past. I don't like history," Scott Thom states. "I'm very interested in the future." □





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The Chronicles Plan



Senator Harrison Schmitt, the former astronaut, launches an ambitious space plan in the U.S. Congress

The first scientist to explore the Moon and the last man to leave his footprints on the dusty lunar terrain, Harrison "Jack" Schmitt has moved from the high technology surroundings of an Apollo spaceship to the traditional, wood-paneled chambers of the U.S. Senate. The 44-year-old Republican from New Mexico hasn't lost one ounce of his adventurous spirit, nor wavered from his conviction that the future of humankind depends on movement to space. In fact, he may be the most farsighted space supporter in Congress. But his ideas and his hopes—which he's translated into legislative action—are based on more than starry-eyed dreaming.

During the closing days of the 95th Congress, Senator Schmitt introduced a bill that has since been dubbed the "Chronicles Plan." Among its more spectacular provisions, the bill would pave the way for bustling space cities in Earth orbit, bases on the Moon, human exploration of Venus and the beginnings of a Martian settlement... all within 30 years.

"What I'm really trying to get out of this," the young Senator explains, "is a commitment by this country to the movement of civilization into space. A commitment to a steady, sustaining effort by the Federal government, in cooperation with the private sector and other nations where appropriate, that says to all future generations that we are going to be the leading spacefaring nation in history.

"I think that is our role to play in history, just as England's role was to be a leading seafaring nation. And it is a role that is fundamentally critical to the survival of freedom on this planet," he states. "There is no other nation that is going to protect that fragile seed of individual freedom that we now protect. The British protected it while we grew up. Now it's our job, until some new civilization—perhaps on Mars—is created. It's not a trivial historical task we're talking about."

Senator Schmitt's bill, formally titled the National Space and Aeronautics Policy Act of 1978 (S-3599), has as its main purpose the continuation and evolution of the space program. It calls for one half of one percent of the Gross National Product to be spent on space activities. Compared to NASA's

Left: Astronaut Schmitt in a farewell pose on the surface of the Moon, with Earth in the sky. He was the last man on the Moon.



Senator Harrison "Jack" Schmitt, the Senate's most outspoken booster of a strong, ongoing space program.

current share of the GNP, one-fifth of one percent, that's not an outrageous increase. But more than increased funding, Schmitt feels that the space program needs goals, a framework of accomplishments and milestones to strive for.

His framework, contained in the Chronicles Plan, sets forth ambitious goals for space, with the purpose of creating multiple options for the future. These goals span the next three decades. By the end of the first decade of the 21st century, if all goes according to Schmitt's schedule, we'll be building settlements on Mars—thus the "Chronicles" tag.

He explains the progression. "The decade of the 1980s is to be devoted to the development of the technology base we already have, to create a World Information System. In its broadest sense, that means perpetuation of communication satellite systems, Earth resources, ocean-related and weather-related satellites, plus the development of a broad range of public service satellites for public health and safety functions as well as educational activities. For instance, developing a hazard prediction system aimed at early warnings of meso-scale weather phenomena and an early warning system for earthquake alerts.

"The technologies for these information systems are already here," he says. "We just need a commitment to using them better than we do now."

At the same time, work would be going on to prepare for the next phase in the 1990s.

"We would need to begin expanding our

technology base so that the decade of the 90s could be a time when many aspects of our present civilization start to move into space and take advantage of the resources there—weightlessness, the high vacuum, and the view of Earth, the Sun and the stars from outside our own atmosphere. All of these are resources that are going to be extremely valuable to future generations, and I feel very strongly that we should be a leader in their utilization.

"I see the decade of the 90s as the time when we begin to establish the kind of 'space station' activity that will provide for research and educational facilities, for manufacturing facilities and for space power generation.

"In doing all that, we would be developing the technology base necessary for us to evaluate whether we should use power generated in space to transmit to Earth. That is something we don't really know whether we want to do yet. We don't know the environmental effects of either high power microwaves or laser beams coming through the atmosphere. But I suspect, based on the ingenuity we've demonstrated in the past, that we'll find that those problems can be compensated for or that they will turn out to be non-problems. We'll just have to wait and see. In the meantime, the need for space power for manufacturing, health care and other kinds of facilities in near-Earth orbit is very real.

"At the same time we're using the technology developed in the 80s to take civilization into space in the 90s, we will need to extend our technology base further. Systematic, steady progress in developing these kinds of technologies is necessary to be able to go to the place that young people all have focused upon: Mars."

The veteran space explorer warms to his subject. "That's clearly the next major adventure. All of this other stuff is extremely exciting and there are many, many exciting and worthwhile things to do with information systems and civilization in space. But if you search the minds of young people today, it's Mars they're thinking about. And I don't blame them," he grins, "because I'd love to have a chance to go!"

Mars is just one of the options provided for in the Senator's Chronicles Plan. "What I'm trying to get the government to do is to tell younger generations of this nation and the world that the U.S. is committed to being the leading spacefaring nation on Earth. Now, the details of how we carry

By PHILIP HARRISON

"If you were born today, you'd be in your early to mid-20s by the time Mars exploration will begin—and you'd be almost too young to take part. If we follow my schedule, the people who are going to explore Mars are in their early teens... the parents of the first Martians are among us now."

out that policy are something we can argue about and discuss all day. But I think the overall thrust of the policy is to say that we're going to *use* the base we have now to *do* things, while we're creating a new base so that we can do other new things in the future."

The Senator's main aim is to actively create new options. "We can't tell the young people what they're going to want to do. But we can listen to them. And one thing that is clear is that they want to have opportunities in space."

At present, Schmitt feels the government isn't actively creating enough opportunities. "The space shuttle is a fantastic option," he concedes, "but while we're busy with that, we're not creating any technology base by which we're going to use it. It's being justified almost entirely on the basis of doing more cheaply what we already do now. That's great, I'm all for that, but let's start doing some new things with the resources we have in space."

While Schmitt asserts the Soviets are years behind the U.S. in technical proficiency, he does think they have the right idea about one thing. "I wish we had as much perspective as they have about the role that space is going to play in the future of Earth and of the human race."

In his original remarks to Congress, the Senator stressed that the Chronicles Plan, or something very much like it, is necessary to sustain a civilization of freedom, and avoid a civilization based on fear. Although such charged remarks may appear to politicize the space program in an era of detente, Schmitt is firm in his opinion.

"I would say I'm just speaking to reality. We and the Soviets are in competition with respect to philosophy of society, and that competition is going to be seen as much in space as it is on Earth. Talking about the movement of a civilization of freedom into space doesn't necessarily mean a military civilization, not at all. It just means that we have to establish a presence in space or it will be dominated by another society. At present, the best candidate is the Soviet Union."

The Senator feels that we have no choice but to move into space. "If we don't and other societies do, we may just lose out here on Earth. Space is going to be the next frontier, the next challenge for human society. I think the United States is uniquely qualified to meet that challenge because

of our history."

Schmitt's legislative blueprint refers to orbiting facilities as "civilizations," rather than as colonies. He doesn't envision space stations declaring independence—not in the near future, anyway.

"When I talk about civilization, I mean the extension of our civilization into this new environment, in the same way our civilization was extended into the western U.S. during the last century. When you talk about a colony, or a settlement on Mars, now that starts to change character somewhat. Early on, I think settlements like that will be supported by Earth."

A grin crawls across his face and his eyes focus on a future he seems to anticipate with some fondness. "But I can see those kinds of settlements developing their own character, their own institutions, with the passage of time. I can see at some point the Earth receiving a message from Mars via laser beam that says, 'We're tired of taxation without representation, and we're going our own way.' And that's great. A representative democracy needs a little revolution every once in a while to perpetuate, to survive."

But because he champions multiple options, independent space stations aren't completely ruled out of the Senator's scenario. "Conceivably that could happen if we went the route advocated by Gerard O'Neill. I don't eliminate that possibility. I've just not spoken to it in the space policy I've advocated. It may turn out to be more economical to create a permanent large station at L-5 rather than doing all these things piecemeal. I think we'll do it piecemeal first, though.

"I'm somewhat excited about what O'Neill argues, but I'm not quite prepared to say I know what all the steps are between here and there. I think I know what some of them are, and once we take those we'll know better whether or not the space colony idea is one that's going to be viable. Certainly planetary settlements, on the Moon or Mars, are viable concepts, because we're used to that. They can be self-supporting."

And the Senator maintains that a self-supporting settlement on Mars within 30 years is not as far-fetched as it may sound at first blush. "The technology exists. It's the engineering systems that don't exist yet," he points out.

"Let me talk about the Moon, since I'm most familiar with that. More than likely,

the basic systems that would support a shirtsleeve environment would be inflatable shelters, either on the lunar surface or underground, possibly some combination of the two.

"The resource base we have there is extraordinarily large amounts of hydrogen in the soil, as well as silicates, which are oxygen-rich rock. With solar or nuclear energy, we could very easily extract the hydrogen from the soil—all we have to do is heat it up. Then, through electrolysis or some other process, we can take the oxygen out of the soil. With hydrogen and oxygen, of course, you have the ingredients for both breathing and water. And the soil on top of the Moon is extraordinarily fertile, we know that. So in terms of sustaining life, it has essentially everything we need.

"A lunar base could sustain itself economically based on one major export—titanium. Over the next 100 years, titanium is going to be what steel and aluminum have been in the last 100 years. It will play that kind of role in the advancement of our technological civilization.

"So I'd say we're set up for a lunar base. Once the thing is established, it will perpetuate itself. Energy is no problem. You can use solar energy during the long lunar day, then switch to fuel cells during the lunar nights."

While he imagines the Moon as mainly an exporting settlement and industrial base, he envisions another role for Mars. "I doubt that Mars will become an exporting settlement. I suspect it will gradually become a self-sustaining economy. People will be there just because they want to. But whether that would actually be the case depends on what is ultimately found on Mars.

"In exploration, one never knows what will turn up. Something on Mars may turn out to be extremely valuable to Earth. Certainly the value of the resources that eventually became the basis of the exporting economies of the original 13 colonies were not the resources that people were looking for when they came to the New World."

And who does he think will explore and eventually settle the red planet?

"If you were born today, you'd be in your early to mid-20s by the time Mars exploration will begin—and you'd be almost too young to take part. If we follow my schedule, the people who are going to explore Mars are probably in their early teens now.

"The people who will settle there are the ones who are being born today. If we follow the kind of schedule that I think our technology and our economy permit, the parents of the first Martians are among us now."

How does a hopeful Martian explorer prepare to take advantage of the opportunity? The Senator sees NASA moving in a positive direction with its de-emphasis on military pilots and inclusion of a broader spectrum of people in the astronaut corps.

"The main reason I went to the Moon," he says, "is because I am a geologist. At the

same time, I had to be as good a lunar module pilot as anybody else that flew. But that is changing. Now we're building our capabilities so that Jack Schmitt, geologist, would not necessarily have to learn all those other skills. As time goes on, and more and more things are tackled in space, people will perform more narrow, specialized activities.

"I think getting a good basic education in engineering and/or science is going to be very important in astronaut selection for the next decade or so. I think it's clear that you need to have a very strong grounding in one or more specialties, but at the same time be able to demonstrate the capability of being a generalist. The selection process will tend to look at how broad a base of academic and working experience you have, in addition to what your specific skills are."

He doesn't believe that a single "space academy" will emerge, charged with the mission of turning out specifically trained astronaut material. "I think it would be much more fruitful to establish within the various universities and military academies what you might call 'sub-space academies.' It would bring a much broader spectrum of people into the space arena, and there'll be more interchange with the space program if a fairly large number of universities are training people, rather than there being just one central space academy."

The spaceman Senator isn't making any overconfident predictions on the success of his "Chronicles Plan" in Congress, but he's quite clear about his reason for proposing it. The nation's space policy has traditionally been set by the Administrative branch of government. It was President Kennedy who gave the go-ahead to the Apollo program that sent men to the Moon. And it was Nixon who, after gleaned all the public relations benefits of these efforts, then began to systematically cancel programs. "Nixon was the one who really made the decisions to cut back and retrench, and that has been perpetuated by Ford and Carter, and concurred in Congress."

But he is quick to add: "It's not that Congress wouldn't have supported a bigger budget." At present, the Carter administration is holding NASA budgeting to half a billion dollars below what Congress would approve.

"From my science contacts in the Administration, specifically through conversations with Science Advisor Frank Press, I became aware that the Administration's space policy was going to be very, very... to be generous, let's call it modest."

Schmitt is not oblivious to inflation and the touchy status of any increase in government spending. But he believes that funding for space is, in the final analysis, a tonic for inflation. "There are some things the Federal government can fund which are deflationary and those 'somethings' generally are centered around research and development. When you create new technology and new science which then feed new

technologies, you are creating, over a period of years, new goods and services. The creation of these goods and services in excess of the amount of money you originally invested is a de-flationary force; a very strong one.

"Senator Adlai Stevenson and I, in various subcommittees on banking and commerce, have tried to examine the role of technology in our time. Our conclusion is that people have to begin to realize that if you're going to have a true anti-inflationary policy, you have to be improving your technology base.

"One of the reasons we have inflation—although not the only reason—is a decrease in productivity, a loss of markets to foreign competition in technical areas where we were once dominant."

Beyond the solid economic sense of ambitious space efforts, Senator Schmitt firmly believes that it is this country's responsibility to create options for the future, for young people. And he concludes that young people do want the space option.

"I think that science fiction, particularly films and television, tend to mirror what people are interested in. The popularity of *Star Wars*, *Star Trek* and *Close Encounters* further substantiates my conclusion that there is a great deal of interest in space and space activities in this country."

As a young boy, Schmitt consumed much of the science fiction written in the 40s and 50s. He thinks the value of science fiction works to the ultimate advantage of the space program. "It is a vehicle by which the mind is stimulated. Particularly for young people, it's like radio—it stimulates

the imagination. Reading and radio are much, much more dynamic for the mind than television. In that sense, science fiction is healthy. It builds an awareness of how little we really understand about our universe... realizing, of course, that we'll never understand everything. That's where science and religion come together.

But just reading science fiction isn't going to move anybody into space. What can a serious space supporter, a young person today, do to insure that the government does its part, actively creating options for the future?

Senator Schmitt settles back in his chair and smiles earnestly. "They need to make sure that their elected representatives understand that this is something they think is very important and that their representatives support it. If they do that, then their voices will be heard. That's what a representative democracy is all about.

"If you never tell your Congressman or your Senator that you're interested in having a strong space program... and a long-term policy for the program... then they're not going to know it and they're going to think that other things are more important to you. That's the best advice I can give. Make sure that the people who you helped elect know what you think is important for the next re-election, one of those things being a strong, goal-oriented space program."

His meaning is implicit: Martians of the future, sit down at your typewriters or pick up your pens, and let your Senators and Representatives know about the options you want in your future. F



Designing a nuclear-powered locomotive: "Supertrain"

Supertrain, the series launched by NBC as the big budgeted "savior" of TV's second season this year, could presently use some saving itself. Recently derailed and revamped by NBC President Fred Silverman, the show has, since February, lost its original two producers and executive producer along the rocky road to success.

In fact, the only star of the show left untarnished over this long stretch of bad track is *Supertrain* itself; a masterpiece of futuristic design. The most expensive set ever constructed for television, each of *Supertrain*'s opulent coaches measures 64 feet long, 24 feet wide and 22 feet high; and boasts such innovative train ideas as indoor discos, swimming pools and atomic powered engines.

In addition to these life-sized sets, a 35-foot "miniature" of the train was also constructed for shots showing the entire train zipping along the countryside.

The creator and designer of both sides of the atomic-powered train is Ned Parsons, a resourceful young movie technician who saw the construction of *Supertrain* as "a major miracle."

Asked in July of 1978 to "start designing the most fantastic train in history," Ned was told in August to have finished sets and miniatures ready for filming in early December. A crew of 250 workers labored in shifts around the clock for three months on the five million dollar set. The resulting locomotive has earned high praise for Parsons from train buffs across the country . . . a fact which amuses Parsons slightly.

"There's not much in *Supertrain* that's actually based on train design," he confesses. "When I started developing *Supertrain*, I began by doing research on older trains and the more progressive trains of today. Most of the train designs were so traditional that I just ducked them."

Joining forces with artist/friend Gary Meyer, Parsons began looking for alternate areas of inspiration. "I went to WW II airplane books," he says, "to pick up air scoops and the like. Air scoops on WW II planes were much more dramatic than the newer ones. I started using that kind of look for the vents of our air-conditioning units and for the exhaust pipes for the side of the train. I spun that off the Messerschmitt 109.

"The canopy designs are from the early planes as well. I fell in love with the old German airplanes. Man, they designed some bizarre stuff during WW II. They were real-



Ned Parsons about to board his super creation. Parsons and his crew built the structure in three short months. "I aged ten years and lived in a trailer on the stage the whole time."

ly weird. They even took planes and piggy-backed them. They were no-holds-barred. I took all I could off those."

"I had a great time taking all these elements and dumping them into one hodgepodge of ideas. Basically, we started *Supertrain* with the idea that it was going to be a two-track runner. It wasn't going to be a monorail or anything like that. It had to be futuristic but traditional at the same time."

Lowering his sights from the skies, Parsons polished his design. "Our headlights are based on the square Cadillac headlights. We have 16 headlights on each side of the train's nose. I figured if you're moving at 200 mph, you need plenty of light up front.

"The front end was spun-off of the present bumper design of today's Corvettes and Porsches. The rear end was spun off the design of a rear end of an automobile. I didn't want to go into the racing car 'spoiler' look but I came up with something that still resembled the tail section of a car, with tail lights and everything. That was fun.

"The console up forward was the result of finding out that most trains are pretty simple in terms of control. Most were fairly stupid looking. So, I began spinning off airplane designs, then took the idea of the automotive dashboard and foisted with both. We made everything bigger than life. I wanted it to look like a huge padded dashboard, so we designed the thing and put naugahyde all over it. Yet, it was frustrating because there just weren't enough things up there for the camera to pick up on. So, I changed the mode of power for the train from turbine to atomic energy. That gave me an excuse to play a lot more with instrumentation. The hardest part was getting the right amount of instrumentation while maintaining enough structural integrity so the whole thing didn't look like *Battlestar Galactica*. I wanted the train to have a sense of reality to it."

"The communications center was basically an update of those old Navy ships.

"Some of our air-conditioning vents were spin-offs of the tops of tanks.

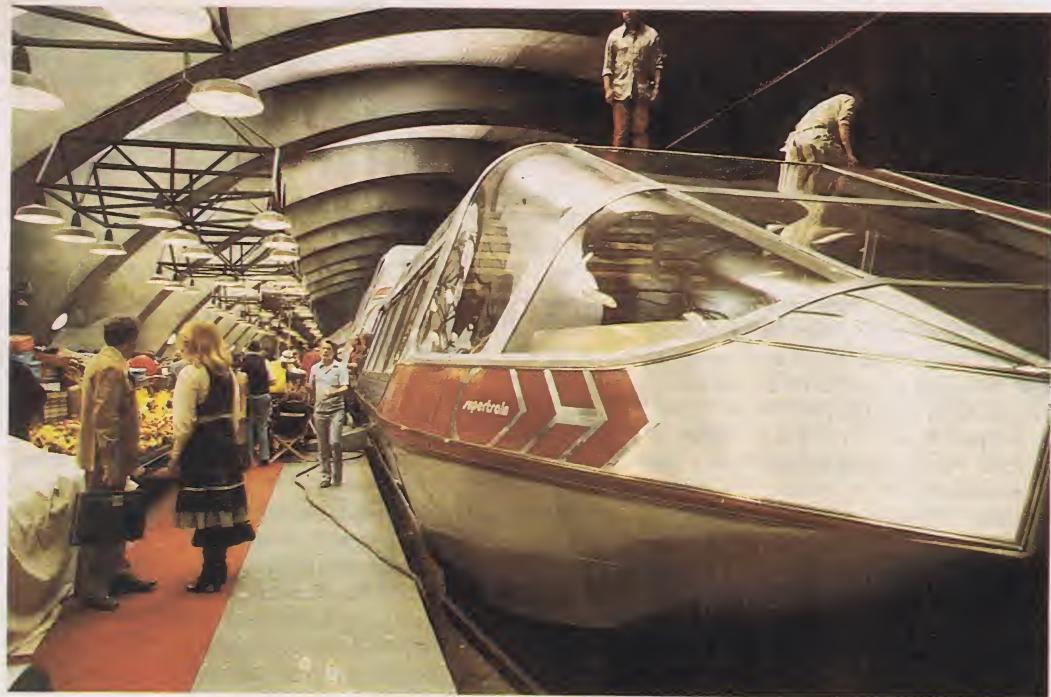
"In dealing with the pool, I was trying to maintain structural integrity while providing glamour. We didn't want to give the pool too high a center of gravity because we were dealing with a structure on wheels. I made the pool lower. At first I was going to have it as an open air thing. I decided to spin off automobile design instead. Now, the pool's roof can open or close depending on the weather like a sun-roof on a car. I had a lot of fun with this particular area because it was fantasyland."

The bearded Parsons is obviously pleased with his work, despite the show's less than super ratings. "This was my first futuristic project and, man, I found myself on this. I loved it. When I was a kid, I got into cars and rockets and bizarre airplane kits. I still have some of that old stuff. And with *Supertrain*, I was really allowed to go no-holds-barred. It was like being a kid again. I could go as far as I wanted to go with it . . . which is a delightful feeling to have."

"And," he adds with a smile, "if you made a mistake . . . who'd notice?"



Above: The front console is based upon several automobile dashboard designs as well as airplane controls. "We made everything bigger than life," says Parsons.



On NBC Stage 27, one of the largest stages in Hollywood (measuring 130 feet by 237 feet, with an 80-foot-high ceiling), sits the full-scale atomic-powered Supertrain engine and three of its massive coaches.



SUMMERTREK

Summertime, when the livin' is easy, the livin' can be stupefyingly boring as well—especially for those of us who live in the future as well as the present. After all, after the fifteenth showing of *Star Wars* or the 2 a.m. rerun of *Godzilla Vs. the Smog Monster*, what else is there to do?

Plenty. All across the U.S. there are museums and planetariums presenting fascinating and informational explorations into the worlds of known and speculative science. And, contrary to the conventional idea of a museum, you are not told to just stand and admire; you are also asked to listen, touch, taste and smell—in

Enlightening excursions on
Planet Earth

By BARBARA KRASNOFF

other words, fully participate in the workings of our universe. Exhibitions can take you anywhere, from the rings of Saturn to the inner workings of the human heart, from the engine room of a submarine to the bridge of a starship, from total fantasy to total fact or an enthralling combination of the two.

In the following pages, we have provided brief descriptions of only a few of these scientifically spectacular attractions—just enough of a glimpse to whet your appetite. And this is only a sampling; there are many more such museums and theaters to be found around the country, and almost every city and college has its own planetarium. So, while you wait for the first tourist flight to Mars, give some of these a try.

Alabama Space and Rocket Center

Calling itself "Earth's Largest Space Museum," the Alabama Space and



Rocket Center houses a very large and impressive variety of exhibits, all relating to space exploration and its relationship to life on Earth. The Spaceship Lunar Odyssey show is a careful recreation of a journey through space and a landing on the Moon, allowing visitors to experience both increased and decreased gravity. There are live demonstrations of space-suits and astronaut training machines, simulators that allow you to land a Moon craft or rendezvous in orbit with the Soyuz, and a multitude of other participatory and learning experiences. The museum's "backyard" contains a collection of actual spacecraft, including one entire 3,000 ton Apollo/Saturn V Moon Rocket.

(Alabama Space and Rocket Center, Tranquility Base, Huntsville, AL 35807. Phone: (205) 837-3400. Open daily year round except Christmas Day. Hours: June—Aug., 8 a.m. to 6 p.m.; Sept.—May, 9 a.m. to 5 p.m. Admission: Museum only: \$3.25 adults, \$1.75 sr. citizens, \$1.50 children grades 7-12, \$1.25 children grades 1-6. Museum & bus tour: \$4.50 adults, \$2.50 sr. citizens, \$2.25 children grades 7-12, \$1.75 children grades 1-6.)

The American Museum of Science and Energy

The American Museum of Science and Energy deals especially and intensively with the topic of energy—the forms it comes in, the ways in which it is utilized, where we get it and where we're going to get it in the future. The museum itself is a program of the U.S. Department of Energy, and offers a wealth of both practical and educational information through such exhibits as "Solar Energy and Conservation" and "Energy for Tomorrow's Power."

But the most fascinating part of the museum is the newly opened "Energy & You" room. Here, visitors can participate in a variety of energy-related activities as they view a multimedia show about the history of oil, try to guess energy sources through the sense of touch, take a computer quiz or influence a color-graphic, touch-sensitive screen program.

(The American Museum of Science & Energy, PO Box 117, Oak Ridge, TN 37830. Phone: (615) 576-3200. Open daily year round, except Thanksgiving, Christmas and New Year. Hours: Sept.—May, Mon.—Sat. 9 a.m. to 5 p.m., Sun. 12:30

to 5 p.m.; June—Aug., Mon.—Sat. 9 a.m. to 6 p.m., Sun. 12:30 to 6 p.m. Admission free.)

Corning Glass Center

In recent years, glass has developed from a largely ornamental medium to one which is widely used in many of today's sciences. At Corning Glass Center's Hall of Science and Industry, the many varying types of glass and their applications in fields ranging from electronics to outer space are examined. Audio-visual learning centers show films on automated manufacture and molecular structure; in other exhibits visitors can test various properties of glass by bending flexible sheets, dunking it in acid or interrupting the flow of high voltage with a glass insulator. Just inside the entrance lobby of the main museum is the first casting of the mirror disk made for the Hale telescope on Mt. Palomar in California.

(Corning Glass Center, Corning, NY 14830. Phone: (607) 974-8371. Open daily year round except Thanksgiving, Christmas and New Years. Hours: 9 a.m. to

5 p.m. Admission: Museum of Glass: \$1 adults, 50¢ students and senior citizens, 25¢ children. Hall of Science and Steuben Factory: No charge.)

Disneyland

Disneyland's Space Mountain is an elaborate, multi-media space travel simulation which provides participants with an exciting, rapid roller coaster ride using sophisticated lighting and computer systems.

After passing through a futuristic Space Port, aspiring space travelers board Disney's sleekly designed coasters and ride up past meteor showers, through a "Solar Energizer" and into the heart of a gaseous nebula. The slow ascent gives way to a fast, twisting descent through a variety of intergalactic sights and sounds, until the coaster finally enters a "cosmic vapor curtain" and returns back to port.

(Disneyland, 1313 Harbor Blvd., Anaheim, CA 92803. Phone: (714) 533-4456. Open daily from May through Labor Day, after Labor Day closed Mon. & Tues. Hours: June 17—Sept. 3, 8 a.m. to 1 a.m.; after Sept. 3 open weekdays 10 a.m. to 6 p.m., weekends 9 a.m. to 7 p.m. Admission plus 11 attractions: \$7 adults, \$6.50 juniors age 12-17, \$6 children age 3-11, under 3 free.)

Disney World

Walt Disney World's Tomorrowland, like its West Coast counterpart, offers visitors an exciting glimpse into Earth's future. Attractions include the WEDway People-Mover, which uses the new linear induction motor; a high speed roller coaster journey through space; and a look at an electronic home.

One of the most popular features is Tomorrowland's Mission to Mars, in which "passengers" take a rocket trip to and around the red planet. Realism is provided through the use of both Disney sequences and actual films of space flights; through loud, wild sounds and sub-audible waves; and through movement of the deck and seats of the "ship's" cabin. Closeup views are provided of Mars' Mariner Valley and the huge Olympus Mons volcano.

(Walt Disney World, PO Box 40, Lake Buena Vista, FL 32830. Phone: (305) 823-2222. Open daily year round. Hours: Mid-June through Aug., 8 a.m. to 1 a.m.; Sept. through mid-June, 9 a.m. to 7 p.m., with extended hours during holidays. Admission plus 8 attractions: \$8.50 adults, \$7.50 juniors age 11-17, \$6.50 children age 3-11, under 3 free.)

Exploratorium

If you're tired of standing respectfully at a distance watching other people play with scientific gadgets, the place to go is San Francisco's Exploratorium. This popular museum, which closely resembles a mad scientist's lair, enthusiastically encourages its visitors to observe, touch, manipulate and otherwise experiment amid a large and fascinating variety of exhibits. You can



Visitors relive the Apollo 11 Moon launch and landing at the Kennedy Space Center.

alter your perceptions of your environment, or change the environment itself through such aides as the Sun Painting, a giant abstract of prisms of light which shifts as people pass in front of or behind it; the Enchanted Tree, whose lighted branches respond in intensity to sound; the Distorted Room with eye-boggling optical illusions; and the Tactile Dome, through which visitors must feel their way in total darkness. The only limiting factor in this museum is your own imagination.

(The Exploratorium, 3601 Lyon Street, San Francisco, CA 94123. Phone: (415) 563-7337. Open year round, Wed.—Sun. Hours: Sept. 5 through July 1, Wed.—Sun. 1 to 5 p.m., Wed. eve. 7 to 9:30 p.m.; July 2 through Sept. 4, Wed.—Fri. 1 to 5 p.m., Sat. & Sun. 11 a.m. to 5 p.m., Wed. eve. 7 to 9:30 p.m. Donation requested.)

Franklin Institute

The Franklin Institute Science Museum and Planetarium, originally founded in 1824 as a dedication to the memory and spirit of Benjamin Franklin, has continually developed through the years. Today it is one of the best examples of a participatory museum in the country. Each exhibit invites visitors to take part in activities that illustrate many different aspects of science. For example, they can follow the path of a blood cell through an enormous heart, take a simulated flight, test out a Van de Graff generator, take a spin ride that makes the most of centrifugal force, and wander through "It's About Time," which examines our sense of time as seen through our timekeeping devices.

Would-be futurologists will be eager to test their skills at the Futures exhibit. With the aid of a computer, they will be able to

detail various aspects of their ideal future society, and will be immediately informed what the ramifications of that particular change would be on society at large.

(The Franklin Institute, Benjamin Franklin Parkway at 20th Street, Philadelphia, PA 19103. Phone: (215) 448-1000. Open daily, year round. Hours: Mon.—Sat., 10 a.m. to 5 p.m.; Sun., noon to 5 p.m. Admission: \$2.50 adults, \$1.50 children age 5-11.)

The International Space Hall of Fame

The International Space Hall of Fame was built as a dedication to the men and women who contributed to space research and exploration. In five floors, the history and accomplishments of the space program are detailed. Exhibits include a full-scale Gemini capsule which is hydraulically operated to give visitors a simulated space flight and landing, an operative X-ray spectrographic telescope similar to those used on the Apollo and Skylab missions, packaged space food and a spacesuit once worn by Astronaut John Young.

Space art enthusiasts will be interested in the *Beyond Tomorrow* exhibition. The 35 color paintings by SF artist Roy Scarfo depict a variety of imaginative possibilities for future life in space.

(The International Space Hall of Fame, PO Box 533, Alamogordo, NM 88310. Phone: (505) 437-5770. Open daily year round except Christmas Day. Hours: May through Aug., 8 a.m. to 6 p.m.; Sept. through Apr., 8 a.m. to 5 p.m. Admission: \$1.50 adults, 75¢ children age 6-12.)

Kennedy Space Center

The John F. Kennedy Space Center is, of

course, the first place any space-happy person would want to see. NASA's major launch site (and the primary launch and landing site for the new space shuttle) has ample facilities for the education and delectation of its guests.

The Visitors Center features both indoor and outdoor exhibits of spacecraft and rockets, and various displays showing space facilities, equipment, and consumer products which were derived from the space program. Guided bus tours are also offered, taking visitors to launch sites, space vehicles and, operations permitting, an inside look at the Launch Control Center in Complex 39 for a multi-media recreation of the Apollo 11 Moon launch.

(Visitors Center, TWA 810, Kennedy Space Center, FL 32899. Phone: (305) 269-3000. Open daily year round except Christmas Day. Hours: 8 a.m. until dark. Admission to the Visitors Center is free. Bus tours: \$3 adults, \$1.75 youths age 13-18, \$1 children age 3-11 with adult. In Florida, launch information may be obtained by calling (800) 432-2153.)

Museum of Broadcasting

The 20th century equivalent of a time machine can be found just off Fifth Avenue in New York City, at the Museum of Broadcasting. The first of its kind, this unique establishment is dedicated to the study and preservation of our radio and television history. Visitors are given access to a steadily growing collection of radio and television programs stemming from the 1920s to the present, which they view at futuristically designed video tape consoles. Programs available range from the ridiculous to the serious: from *I Love Lucy* and the *Smothers Brothers* to the first Moon walk and the Vietnam conflict. A number of science fiction broadcasts are available—for example: Columbia Workshop radio dramas such as *R.U.R.* and *The Tell-Tale Heart*; Mercury Theatre's famous dramatization of *The War of the Worlds*; and three *Star Trek* episodes.

The museum is now undergoing an expansion to accommodate the large number of people who have come to use its facilities.

(The Museum of Broadcasting, 1 East 53rd Street, New York, NY 10022. Phone: (212) 752-4690. Open year round, Tues.—Sat. Hours: Noon to 5 p.m. Admission: \$1.50 adults, 75¢ under 13.)

Museum of Science and Industry

Chicago's Museum of Science and Industry features hundreds of multi-media exhibits illustrating applications of science and technology in industry and other fields. Elaborate and colorful presentations invite visitors to participate in and learn about such diverse topics as holography, mathematics, solar and nuclear energy, satellite communications, advances in human and animal medicine, and oceanography, among others. Many of the ex-

hibits have been provided by leading manufacturers, governmental departments and private organizations to provide information about their particular field: for example, NASA has contributed the Apollo 8 Command Module and a lunar module used in astronaut training programs; Eastman Kodak organized a photography exhibit which includes demonstrations of holography, electron microscopy and space photography; and the U.S. Department of Energy provided a comprehensive look at over a dozen of today's energy sources.

Annual attractions include NASA space science education programs in August, and an exhibition of the 100 most significant new technical products of the year during September and October.

(Museum of Science and Industry, 57th Street and Lake Shore Drive, Chicago, IL 60637. Phone: (312) 684-1414. Open daily year round except Christmas. Hours: May 1 through Labor Day, 9:30 a.m. to 5:30 p.m.; Labor Day through Apr. 30, weekdays 9:30 a.m. to 4 p.m., weekends and holidays 9:30 a.m. to 5:30 p.m. Admission free.)

National Air and Space Museum

The National Air and Space Museum is world famous for its exciting presentation of the history of flight, up to and including all recent developments in the space

program. Visitors can take in everything from the 1903 Kitty Hawk Flyer to a Skylab orbital workshop.

Aside from the fascinating collections of authentic artifacts, many of the museum's galleries feature participatory exhibits. For example, you can make a descent to Venus in the cockpit of an interplanetary spaceship (circa 2150 A.D.), indulge in a short trip over Mars and test your knowledge of the solar system at the Space Academy Exam's computer consoles. Or learn to fly a plane using two different types of General Aviation Trainers, which take trainees through various flight maneuvers. Planetarium productions are offered in the Albert Einstein Spacearium, and the museum theater shows films specially prepared for the museum on a screen five stories high and seven stories wide.

(National Air and Space Museum, Washington, D.C. 20560. Phone: (202) 381-4222. Open daily year round. Hours: 10 a.m. to 5:30 p.m. Admission free.)

Omniplex

Oklahoma City's Omniplex offers the inquisitive a variety of exhibits dealing with different aspects of science. Daily demonstrations give visitors a chance to manufacture paper, make friends with a snake and recreate a chemistry experiment.

Participatory activities include a working weather station with satellite pictures; Gravitrax 2, a maze of brass and copper where steel balls continuously travel; Votrax, a computer which talks through the phonetic application of keys; and a holography exhibit. The museum also contains the Kirkpatrick Planetarium, which presents a continuing program of star shows.

(Omniplex, 2100 N.E. 52, Oklahoma City, OK 73111. Phone: (405) 424-5561. Open daily year round except Thanksgiving, Christmas and New Year's. Hours: Labor Day through Memorial Day, Mon.—Sat. 9 a.m. to 5 p.m., Sun. 1 to 5 p.m.; Memorial Day through Labor Day, Mon.—Sat. 10 a.m. to 6 p.m., Sun. noon to 6 p.m. Planetarium admission: \$2 adults, \$1 children under 13. Museum admission only: \$1 adults, 50¢ children under 13, under 6 free.)

Omnisphere

In Wichita's Omnisphere Earth-Space Center, the audience can take a voyage to the stars or back through time with the aid of the theater's star projectors and special effects equipment. A variety of multimedia shows are shown on the 30-foot domed projection screen, and the feeling of reality is enhanced by the wrap-around effect, coupled with lowered horizon projection. Past shows have included a dramatization of Isaac Asimov's famous short story "The Last Question," and a close look at the spectacular death of a star.

(Omnisphere Earth-Space Center, 220 South Main, Wichita, KS 67202. Phone: (continued on page 64)



A young woman has a hair-raising experience at the American Museum of Science and Energy's "Atoms and Atom Smashers" exhibit.

PHOTO: AMERICAN MUSEUM OF SCIENCE & ENERGY



The Radioactive Blues

By ED NAHA

ately, the Carter Administration has been attempting to interest both Congress and the American public in the refurbished concept of nuclear warfare. Attempting to bolster a sagging defense budget, Carter aides have been stressing the importance of mass evacuation plans, new anti-nuke attack missiles and neutron bomb-type weaponry in their bid for increased military bucks.

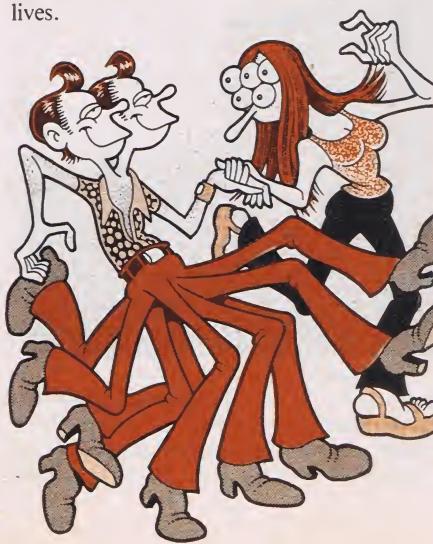
Unfortunately, not too many Americans have paid much attention.

In an effort to bring the concept of total nuclear destruction down to the level of the common individual, the Administration has come up with the *Ten Most Frightening Results of Atomic Warfare*; an easy to read list of Armageddon's greatest hits. Later this year, special Carter nuclear advisors O.J. Simpson, Suzanne Somers and Kiss will take this morose message to the people.

Here's a sneak preview, leaked by White House aides, of the worst fates that can befall post-nuked America.

1. Bad TV Reception

An out and out nuclear holocaust dramatically reduces the effectiveness of video airwaves, causing great inconvenience for surviving *TV Guide* readers. Following the bomb blasts at Hiroshima and Nagasaki, for instance, most local resident complained bitterly about the sudden absence of *I Love Lucy*, *The Merv Griffin Show*, *Family Feud* and ocular functions from their lives.



2. Total Lack of White Bread

Scientific tests have proven that, in the event of a radioactive cataclysm, white bread would cease to exist . . . thus bringing about great hardship for all those citizens who prefer white bread to rye because of all those little seeds that often find their way into the rye and, without fail, into the crevices between your teeth. Besides the elimination of white bread from the face of the Earth, scientists speculate that excessive nuclear fallout would also cause the extinction of certain strains of Twinkies, fast food hamburgers, child-proof aspirin bottles and human beings.

3. Mutation

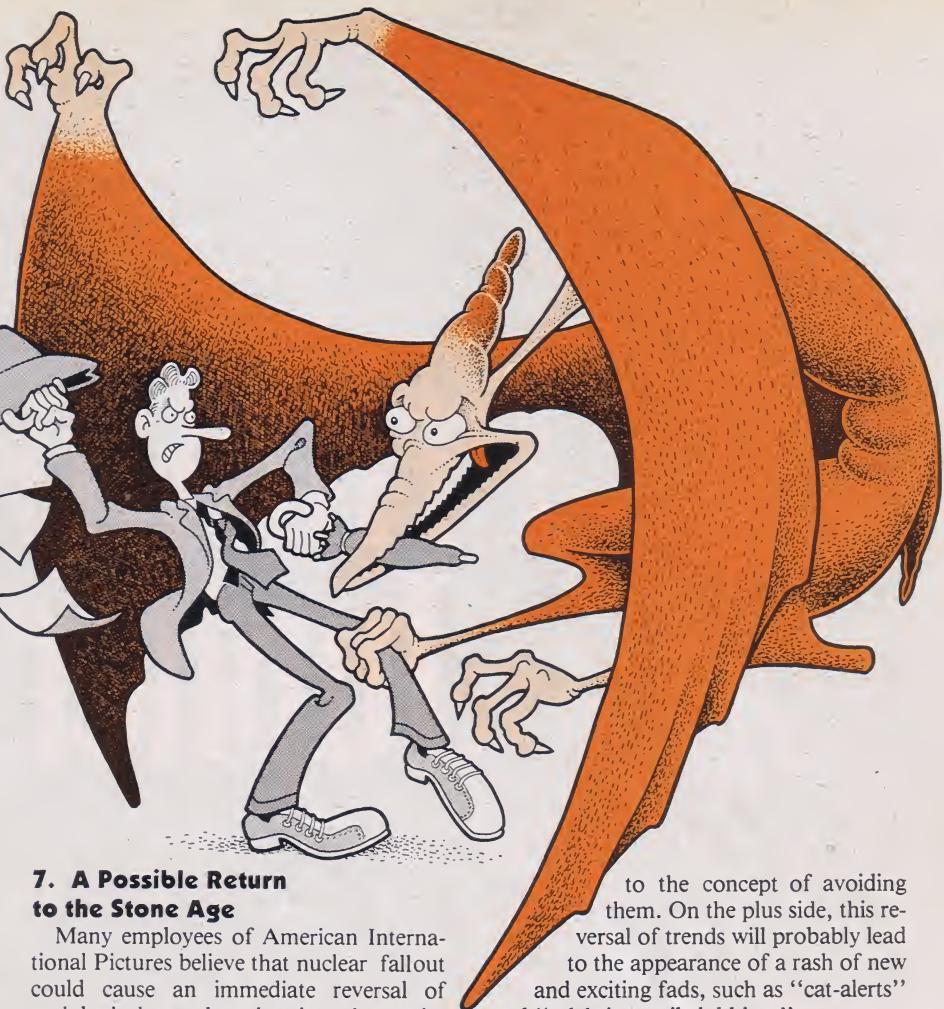
In the wake of a nuclear disaster, the nation's top dermatologists fear an outbreak of physical mutation among survivors. While certainly not fatal, the annoyance factor involved in this after-effect would be intolerable. The sprouting of extra eyes, hands, noses and tails would not only upset one's social life ("Excuse my dancing tonight, Madge, I seem to have 17 left feet."), but would also render one's existing wardrobe and supply of Clearasil useless.

4. An End to Jogging

It has been proven in various studies that a nuclear accident of any type destroys all Adidas running shoes within a one hundred mile radius of the nuke site . . . as well as all jogging paths and jogging appendages.

5. The Collapse of the Two Party System

In the event of total armageddon, there is speculation that America's two party system of democracy will collapse, probably to be replaced by the two gun, two spear or one ambush system of rule. At present, these latter systems of government are being practiced in some areas of New York City.



7. A Possible Return to the Stone Age

Many employees of American International Pictures believe that nuclear fallout could cause an immediate reversal of sociological trends, plunging the entire world into a prehistoric existence. Fearing such a likelihood, several ecological groups in Detroit are teaching local businessmen how to fend off a pterodactyl attack using only their briefcases and sarcastic remarks.



6. Lousy Movies

Informed sources at both the Pentagon and *Variety* concede that an atomic catastrophe will very likely send both the television and the motion picture industries back decades. It is feared that an unsuspecting public will be forced to endure such post-holocaust Hollywood productions as *Saturday Night Fever* and *Retching*, *Return of Up In Smoke* and *I Was a Teenaged Hand*. Furthermore, TV series such as *Muck and Mindy*, *Mr. Roentgen's Neighborhood*, *R*A*S*H* and *Sesame Crater* seem inevitable. The paperback book trade would seem to be headed in an equally disastrous direction except that, in all probability, there will be no such thing as paper by that time — a real blow to *Cosmopolitan* subscribers.

to the concept of avoiding them. On the plus side, this reversal of trends will probably lead to the appearance of a rash of new and exciting fads, such as "cat-alerts" and "celebrity snail clubbing."

9. Rebirth of Tribal Warfare

A program conducted by several groups of thin people with glasses predicts that, in the years immediately following the holocaust, humanity will split up into several groups of tribes; thus effectively postponing the reunification of civilization as a whole for centuries. In addition, these tribes will battle constantly. Current projections pinpoint massive warfare on the West Coast where the Teamsters will do battle with the estians for the possession of their "own space" and on the East Coast where the Saks Fifth Avenue Tribe will be constantly assualted by roving bands of psychotherapists.



10. The Fall of the Dollar

Despite all efforts made by the Treasury Department, one of the most frightening effects of a nuclear disaster will be the elimination of the dollar from all monetary transactions. Banks will encourage spending by offering special nuke "growth" bonds: green and scaly and spreadable. Wall Street predictions envision the dollar being replaced by either U.S. Savings Bonds or live chickens. Sales tax, either in the form of personal checks or untainted Hershey kisses, will vary from state to state and crater to crater.

Primitive Jupiter

The Mysterious Super Planet

By JAMES R. STUART

When our solar system was formed some five billion years ago, there was the Sun and there was Jupiter...and very little else. Of all the matter left over from our Sun to form planets, 98 percent went into the creation of a super planet: Jupiter.

Jupiter is so huge—its volume could hold 1,317 Earths—that an outside observer might easily regard our solar system as a two-body group: the Sun and Jupiter.

Jupiter's massive gravitational attraction wrenches comets from their orbits, tugs at every other planet in the solar system, and may be responsible for preventing the asteroid belt between Jupiter and Mars from coalescing into another planet.

Because of its powerful gravitational attraction, Jupiter has kept even the lightest gases in its atmosphere from escaping. The cooked inner planets—Mercury, Venus, Earth and Mars—have undergone enormous evolutionary changes over the past four billion years. But because of Jupiter's

distance from the Sun, it has evolved so slowly that conditions today may not be very different from what they were back at the time of formation. Looking at Jupiter is like going back in time, observing the primitive solar nebula which spawned the Sun and planets.

The study of Jupiter is the most exciting archeological/astronomical expedition ever launched by human beings.

The current Voyager mission is giving us the closest look yet at primitive Jupiter. Voyager 1 flew past the colorful banded planet last March and Voyager 2 will follow in July. The spacecraft cameras are taking hundreds of color pictures of Jupiter's bright red and yellow bands, and of boiling storms like the Great Red Spot. The pictures are transmitted back to Earth daily, across distances so great that the radio signals must travel at the speed of light for more than 40 minutes to reach the scientists at the Jet Propulsion Laboratory in California. The Voyager spacecraft are aiming an incredible collection of scientific sensors at Jupiter—four times as much instrumenta-

tion as was carried on the pathfinding Pioneer spacecraft. Voyager is gathering data and sending it back to Earth at 100 times the rate Pioneer did, and with ten times the quality of any planetary spacecraft ever flown.

We are getting our best look ever, learning more and more about mysterious primitive Jupiter and its fascinating planet-like moons. Some theories are confirmed, others washed up. And for every question answered, ten new questions are asked.

Voyager's discoveries of a thin ring around the planet and of active volcanoes on its moon, Io, rather than settling all bets, simply open whole new fields of inquiry.

Jupiter has fascinated and mystified humans since the first time our ancestors noticed that certain stars appeared to meander in the heavens and named them "planets" or "wanderers." It was in 1610 that Galileo stunned the world when he looked through his first primitive telescope and announced that he had discovered four Jovian moons. The four satellites, called the



Jupiter and two of its largest moons are seen in this Voyager photo taken from a distance of 17.5 million miles. Io is seen against the planet, while Europa is off to the right.

"Galilean satellites," are Io, Europa, Ganymede, and Callisto. They are Jupiter's largest, and range in size from the planet Mercury to our own Moon.

The world was rocked by Galileo's discovery Copernicus had been right—the Earth was not the center of the universe. Might these planets be worlds like our own? Violent arguments and inquisitions raged over the new perspective. Each new century found humans taking small, painful steps to get a better look. It was almost 300 years after Galileo that Jupiter's fifth moon was found. Now we have discovered a total of at least 13. (A 14th may have been seen recently by C. T. Kowal of Caltech, who also found the 13th in 1974.)

Earth-based telescope observations have raised more questions than they have answered. During observations in the 1950s, radio astronomers found evidence for an enormous magnetic field around

vide the heat output observed), or a continual cooling since Jupiter was first formed.

Jupiter may harbor life. Its atmosphere, which contains modest amounts of methane, ammonia and water vapor, is similar to the primitive atmosphere of Earth. In laboratory experiments with a simulated Jovian atmosphere, biologically significant organic molecules are formed when the atmosphere is exposed to ultraviolet radiation like that of the Sun and of lightning. Based on these experiments, there is speculation that pre-biological activity like primordial Earth's—or perhaps beyond—could be taking place in the Jovian atmosphere.

But closer looks are needed to unravel the many mysteries of the Sun's fifth planet.

The first steps to get a clearer look at Jupiter began with the launching of Pioneers 10 and 11. In 1973 and 1974, these spacecraft flew by Jupiter and provided the

somewhat changed planet.

A notable difference between the Voyager and Pioneer views of Jupiter is that the famous Great Red Spot is less conspicuous, more muted in color. The wide, white band that once enclosed the spot now merely sweeps along its southern edge, replaced elsewhere by darker, more turbulent material which probably represents a deeper look into the atmosphere. The northern hemisphere shows the reverse situation: where there were once thin bands of various hues, there now appears a wide, white swath much like that formerly seen in the south.

The visible surface of Jupiter is spectacular. From an Earth-based telescope, it appears as a magnificent banded disc of whirling, turbulent clouds. By convention, the light cloud bands are referred to as zones and the dark ones are called belts. Generally, the light zones are cool, high clouds,



Above: Jupiter's Great Red Spot (upper right) and the turbulent region immediately to the west, seen from Voyager far better than from any telescopic observation. Right: The first volcanic eruption ever seen on another planetary body, a dramatic plume-like structure rises more than 60 miles above the surface of Io, at explosive velocities of more than 2,000 miles an hour.



Jupiter when they discovered powerful radio-frequency emissions coming from the planet. Except for the Sun, Jupiter is the noisiest radio source in the sky. These radio bursts are periodic, and mysteriously tied to the orbital position of Jupiter's second moon, Io. The energy contained in its radio bursts is equivalent to a one-megaton hydrogen bomb exploding every second!

Like a small star, Jupiter has its own internal energy source, radiating over twice as much energy as it receives from the Sun. (In fact, if Jupiter had been 60 times larger, the temperature at its core would have been high enough to trigger nuclear fusion reactions. If that had happened, our solar system would have been a binary star system.)

Scientists speculate that Jupiter's internal energy comes from either gravitational collapse (a continuing gravitational collapse at a rate of one millimeter per year could pro-

first close-up inspection of the complex super planet. Pioneer images surpassed the best of the previous Earth-based pictures. As Pioneer 10 passed safely through the asteroid belt, it found, surprisingly, that the concentration of dust particles was no greater than that found closer to Earth. That revelation was totally unexpected, as puzzling as it was revealing. Seemingly, Jupiter acts like a giant interstellar vacuum cleaner, sucking in cosmic dust and debris from a vast region of space.

The flyby also revealed that Jupiter's radiation belts are from 10,000 to one million times as intense as Earth's Van Allen Belts. Indeed, if Pioneer 10 had gone 65,000 miles closer to the planet, the intensity of the radiation would almost certainly have melted the vehicle.

Now the Voyager spacecraft are making much "smarter" observations than Pioneer could. In addition, Voyager is revealing a

while the dark belts are lower, warmer clouds. Gas warmed by Jupiter's internal heat rises and cools in the upper atmosphere to form clouds of ammonia crystals. At the top of the zones, the cooler material moves toward the equator or poles, then is deflected in an east-west direction by Coriolis forces and finally sinks back to lower altitudes. On Earth, a very similar mechanism causes our trade winds. The study of Jupiter may contribute to a better understanding of weather patterns on our own planet.

While many of the belts and zones have features permanent enough to be given names, Jupiter is also a stormy, turbulent planet of whirling clouds, thunderstorms and supersonic jet streams. Storms rage and vanish, and detailed features change over a period of days or even minutes. Such small features are described by names like streaks, arches, loops, wisps, patches, lumps,

plumes, festoons and spots. Because Jupiter is so immense, these "small," detailed features are still thousands of miles across, circling the planet at greatly varying speeds.

The equatorial clouds sweep around the planet 250 miles per hour faster than cloud regions only 10° latitude away. The bands widen and narrow, and move back and forth from the equator. And while all this is going on, Jupiter's soft, muted colors slowly change. Over the years, the zones appear to vary from gray to reddish brown. The bands fade and darken, shifting color like an incredible, slow kaleidoscope.

something floating in the upper atmosphere, since the spot drifts around the planet and seems to move among the clouds. Often, cloud currents sweep around it as though the spot were a vortex in the atmosphere. More recently, scientists guessed that it might be a column of gas, the center of an enormous whirlpool-like mass rising from deep in the planet to the top of the atmosphere, anchored in some way far below.

We now know the Great Red Spot to be a spectacular hurricane-like structure, a fantastic grouping of "thunderstorms." Soaring 15 miles above surrounding clouds, the

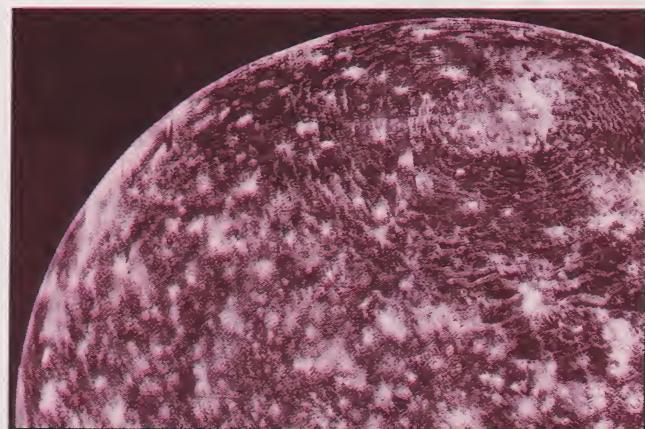
dense as water. It is composed mainly of the lightest gases, hydrogen and helium, the same gases that are the most common in the Sun and stars. It probably has no solid surface. The center may be made of liquid metallic hydrogen, a substance never before seen on Earth because of the tremendous heat and pressure required for its existence.

Because of its makeup, some interstellar exploration studies have considered that Jupiter would make an excellent hydrogen refueling stop. The solar system's most intriguing gas giant may one day become an interstellar gas station.

Even now, as excited scientists at the Jet



PHOTOS: NASA/JET PROPULSION LABORATORY



Jupiter's four largest satellites, the Galilean moons. Top left: Europa is thought to have a rocky interior and be covered with water ice. The most unusual features are the long linear structures, over a thousand kilometers long. They may be fractures or faults. Bottom left: Ganymede, the largest Galilean moon, probably composed of a mixture of rock and ice. Bottom right: Callisto, perhaps the oldest of the four. The large bullseye feature at top is probably an ancient impact basin. Top right: Perhaps Voyager's most exciting discovery is that Io is riddled with active volcanoes (see page opposite).

But of all the fascinating features on Jupiter, the most curious one of all rests in the southern hemisphere. It is a huge, mysterious oval known as the Great Red Spot. At least 15,000 miles long, it has sometimes extended itself to over 30,000 miles. It could swallow the entire Earth.

The red area has captivated generations of astronomers since it was first observed and recorded centuries ago. Called the "Eye of Jupiter" as early as 1665 by the Italian astronomer Cassini, the spot has appeared to vanish from time to time. In 1883, the redness seemed to fade completely. Within a few years, it became very distinct again. Early American astronomers thought it might be a raft or an island,

whirling red storm is the coldest place on Jupiter.

The planet measures 82,967 miles from pole to pole, compared to Earth's 8,000 miles. There is little or no change of season on Jupiter, because the axis of its rotation is nearly parallel to the axis of its orbit around the Sun. Rotating faster than any planet in the system, a Jovian day is a little less than 10 hours long. This means that any point on Jupiter's equator moves at over 22,000 miles per hour, as compared with 1,000 miles per hour for a point on Earth's equator. Under the strong centripetal force of its rapid rotation, Jupiter's equatorial regions bulge noticeably outward.

Jupiter is only one and one-third times as

Propulsion Laboratory and across the country analyze the new wealth of data returned by Voyager 1, another closer look at the super planet is being planned. The Galileo spacecraft is being designed and built by NASA/JPL for its launch from the space shuttle in 1982. Galileo will orbit Jupiter for continued close-up investigations of the mysterious planet. Most exciting of all, a probe will be sent down for a first-hand examination of the turbulent atmosphere. Galileo faces some fierce obstacles in its mission. But an unprecedented long, close look at the primitive super planet—and the new knowledge it will provide about the origin of our solar system—is worth the challenge.



The World On a Silver Platter

DiscoVision Debuts in Atlanta

By MICHELLE GREEN

What we're selling is not a system or a product. We're selling a way of life. We're selling entertainment."

Entertainment, indeed. The occasion is a late-winter press conference in the lavish Hyatt Regency Atlanta hotel. A phalanx of press representatives, marketing specialists and local retailers have gathered at the behest of the Magnavox Corporation to view the latest mass-market electronic diversion: the videodisc. Or—as Magnavox trendily terms it—DiscoVision.

A multitude of TV cameras grind away as Magnavox vice-president Kenneth Ingram, a hulking man encased in an expensive three-piece suit, lists the merits of the system. Versatility, Ingram says. Viewer control. Options. Picture quality.

Ingram is lodged behind a lectern bearing the flashy DiscoVision logo—underneath which is the slogan: "The World on a Silver Platter." Before him is the highly-touted machine itself. It is a sleek, inscrutable-looking device which, at first glance, resembles a super-sophisticated phonograph turntable. But this little gadget—as any Magnavox retailer will be happy to tell you—will do much, much more than merely deliver sound.

The highly-reflective silver disc which fits onto the turntable contains TV signals encoded in infinitesimal bulges in the base of its spiral track. When the disc is placed on the turntable and the protective lid is closed, the record begins to spin at about 1800 rpm. A low-power laser directs a slim beam onto the whirling round of aluminum (which is protected by a tough, clear plastic coating). The disc reflects a portion of the laser light back through an optical system to a light-sensitive diode which, in turn, relays the encoded picture and sound to a conventional color television, where razor-sharp images—notably superior to the video-cassette version—and high-quality sound appear.

An interesting little item; one which was peddled for \$695 in the Atlanta area during

a special winter test-market run. And, according to the Magnavox people, it's not just for the diehard electronics buff. They predict, rather windily, that the videodisc will affect the American lifestyle as much as TV itself did. In Ingram's words, it will become "a way of life."

This device, they say, will liberate us from the lowbrow confines of network television. Allow us to immerse ourselves in first-rate movies, uplifting educational programs and soul-stirring operas rather than suffering the standard network drek: *Three's Company*, *Family Feud*, and the like. The Magnavox catalogue (which will eventually include 1,000 titles) currently lists 200-odd selections, including excerpts from *The French Chef*, made-for-TV movies like *Battlestar Galactica*; feature films such as *The Godfather* and *King Kong*, and classic films, *Animal Crackers* and *Francis, the Talking Mule*, among them.

Not only does the disc system offer the video fan a great number of program choices, but it can perform stunts that even the most sophisticated traditional TV—or video cassette system—couldn't touch. Each virtually indestructible LP-sized disc contains up to an hour of picture and sound; the images can be stopped, held, sped-up, reversed or played in slow motion. There are as many as 54,000 stills on each side of the videodisc; they are numbered sequentially and can be located at will. As the Magnavox folks like to say, a single side of one of their video-records could accommodate slides of all of the world's great artworks. One could—if he were so inclined—glimpse at the great masters without leaving his easy chair.

"You," booms Ron Hill, Magnavox assistant sales manager, "control what you see on the screen." He is at the compact keyboard of the miraculous machine, manipulating dials and pushbuttons like a clean-cut clone of Lon Chaney in *The Phantom of the Opera*. He is treating the assembled ladies and gentlemen of the press to a demonstration disc of *Smokey and the Bandit*. Hill twitches a hand over the controls

and the movie is halted at a single frame. It shows Sally Field and Burt Reynolds running right over a good-old-boy in their dusty red death-mobile. He stabs at the reverse switch, and Sally and Burt back up to run over the poor guy again.

Another radiant disc is nestled atop the turntable; instantly, an ear-splitting film of an Elton John concert comes into focus. The DiscoVision sound track can be played through any stereo; this one is channeled through a pair of giant speakers to reproduce the authentic Elton sound. The British rocker gives way to *Columbo*, who is used to illustrate the system's spiffy discrete-track recording. A touch of the switch, and the rumpled hero speaks in English. Press the switch again, and the dialogue's in an Arabic tongue. "You," Hill repeats, his eyes glazing, "are in control."

The backers of this flamboyant contraption are betting a sizable sum on the American consumer's desire to control his video fare. By one estimate, several hundred million dollars—or thereabouts—have been invested in the videodisc system; a system which has been waiting in the proverbial wings for several years now. Because, although the necessary technology has been available for a while, electronics firms have hesitated to take the financial plunge and place a disc system on the U.S. market. RCA, for example has been working on its own version of DiscoVision since 1964, but has yet to offer its now-perfected system.

The device test-marketed in Atlanta (and scheduled to appear on the national market in 1980) is the result of a collaboration between N. V. Philips, the behemoth Dutch corporation, and MCA Corporation (the owner of both Universal Pictures and Decca Records). In 1974, Philips acquired Magnavox; its directors wanted the American company to distribute the video system that it planned to market here. And MCA and Philips struck an agreement: Philips—the world's largest manufacturer of television sets—would manufacture the hardware; MCA, the records.

Soon afterward, rumors of the imminent



1979 MAGNAVOX
PHOTO

The compact Magnavision optical videodisc player is about the size of a tabletop phonograph and attaches to a television set through its antenna system.

appearance of a mass-market videodisc player began to pop up. A disc system eventually appeared in Europe, but met with a ho-hum response (probably because its records held only ten minutes' worth of material). Meanwhile, Philips-MCA marketing mavens were gearing up to launch their new machine. They devoted two years to market research alone, finally settling on Atlanta as the first test site. The Southern city pulled the honor, Magnavox officials say, because of its "upscale demographics"—a high average-income level; a large number of homes with color television (signaling a ready market for their system); a cosmopolitan population and a plethora of Magnavox dealers.

Although the production of the DiscoVision system has required sizable investment, it appears that Philips and MCA may just make a profit, after all. Three Atlanta stores were selected as DiscoVision dealers; all but one sold their entire allotment by the end of the first day. "The response has been incredible," said a spokesman for one of the stores. "We've been getting calls from all over the country. And we're sold out for the next two months."

On the first day, Magnavox sold 50 players in less than 20 minutes—on the strength of just two full-page ads in local newspapers. Calls came in from as far away as Nassau and Munich, and a couple of avant video buffs flew in from Boston and Acapulco to secure their first-run DiscoVision units. Magnavox has since received orders for at least 900 more, and has stepped up production accordingly.

One of the Atlantans who arose early on the designated day to queue up outside a DiscoVision outlet was Ray Kuehne, a 35-year-old computer-firm systems analyst; he was shivering at the door of a suburban

Magnavox dealer at 5:30 a.m. on December 15. Kuehne is a rabid electronics buff. Alongside the Dali prints and bright Danish contemporary furniture in his comfortable exurban home is an intricate stereo system that he has been adding to for 15 years. He was galvanized when he read a late-November *TV Guide* story announcing that Magnavox would be marketing the machines in Georgia; he launched a feverish two-week search to discover where—and when—he could get one. Two months after he finally snared his video-disc player, he's still mesmerized by the gadget.

"It's borderline magic," he says reverently. "It really is."

"This is truly a revolutionary device," he adds. "No pun intended. It's the biggest thing in terms of changing lifestyle since TV itself." Magnavox's promotional points, it seems, have been well taken.

Kuehne, his wife, and his two small sons assemble before the machine for an average of two hours each night. They devour pre-recorded programs such as *The Slipper and the Rose* (a version of Cinderella); Fellini's *Casanova*, and *Math That Counts*, an Encyclopedia Britannica short feature for the young set. They are delighted with their investment; they relish the fact that the transmission is superior to network-television fare, and they revel in the knowledge that their DiscoVision shows won't be interrupted by ads for *Ajax* or *Summer's Eve*.

Since December, they have amassed a number of Magnavox discs (which retail at phonograph-low prices—\$5.95 to \$15.95). "We've purchased several more feature-length movies than we'd anticipated," Kuehne reports. "That's primarily because the other material's been slow in coming—the operas, the ballets, and those things. The latest estimate is that only about

50 percent of the titles in the Magnavox catalogue are available now." He's not complaining, though. "We're just filling in with programs that we feel have a lasting value. We want the things we'll watch again and again."

Unlike the Betamax-style video cassette recorders which have sold so well in recent years, none of the videodisc players (including the RCA model) can record a televised program for later viewing; something that DiscoVision owners claim didn't deter them from buying the Magnavox machine. "I feel that the video recorder and the disc system are complementary devices—like a tape recorder and a record player. They serve different functions, as far as I'm concerned. And for day-in, day-out service, the disc is what I want," says Kuehne.

Sure enough, a market profile of DiscoVision buyers reveals that most already own a video cassette machine. The Magnavox device has at least one factor in its favor: its programs are far less expensive than those offered in tape form. In videotape, a feature-length film goes for \$50 to \$70; the same movie costs only \$15.95 as a video disc. Magnavox executives don't claim that their product will supplant the video cassette machine—which would be an impressive feat, since 450,000 to 500,000 of the VCRs were sold last year. They do claim that, rather than directly competing with the cassette system, the disc player will stand on its own merits—and their customers apparently agree.

So far, the showy elements of control—fast-forward, freeze-frame, self-programming, and the like—are the key marketing ploys. As Magnavox's Hill said during the Atlanta demonstration, *you* control the screen; *you* control the content; *you* escape commercials; *you* have the convenience of a relatively inexpensive, hardly constructed piece of hardware. And *you*—providing you can get your hands on one of the machines—are a virtual video pioneer.

You and Atlanta's Roy Kuehne, that is. "I really believe that, after the disc catalogue expands, anybody who sees the videodisc transmission, who gets to know the system, won't want to go back to network TV," he says. "It's going to be like the advent of color TV; all of a sudden, black-and-white seemed... ordinary."

The systems analyst becomes almost breathless as he celebrates the technological toy. "I can see it supplanting regular TV," he adds, his voice rising like Martin Luther King's in his legendary "I have been to the promised land" oration. "I can picture videodisc exchange services—lending libraries, even. All that knowledge, right at your fingertips."

"I think network TV will continue to be important for live events, but for entertainment; well, just think. For the same price as a phonograph record, you get the sound and the images. And if you want to go get a beer, all you've got to do is flick a switch to stop the program."

"It's magic," he says happily. Are you listening, RCA?

Holography

(continued from page 23)

At the very least, it provides a wonderfully fertile interface between the imaginative sensibilities of the artist and the nuts and bolts hardware provided by physicists and engineers. An example of this is an incredible hologram created by the artist Selwyn Lissack. Taking an image gathered by an electron microscope of an actual sickle cell in a human body, Lissack blew the hologram up in size and added rainbow-like holographic color to it. As a geometric design the sickle cell stands as a wondrous piece of art. The colors are as impressionistic and delicate as a Pacific sunset. But the image comes from an electron microscope. The hologram has value to both a medical researcher and an art collector (it sold at a very good art gallery in 1976). It hangs in seeming mid-air, an astonishingly full three-dimensional hologram.

Holography's potential must be tied to the fact that today, almost anyone with about \$2000 to invest in basic equipment can make one. The sand-table technique (see sidebar) is adaptable anywhere, and it produces holograms of great clarity.

There has been talk of holographic cinema and television. Sony has produced a laboratory prototype of a true 3-D television apparatus, but it is only in the development stage and one should not look for holographic TV in the immediate future. Then too, American film producer Joseph Strick took out a license several years ago to make the first holo-cinematic film. But the process became far too expensive for him, and the license expired. So far, holo-cinema has only been developed in Russia and, there too, only in a lab. But the prospect of full color, whole message images (like Princess Leia's cameo, ersatz holo appearance in *Star Wars*) floating through a movie theater is something we may well see in the next 10 years—provided somebody spends the money to make it happen.

Ultimately, holography's potential impact on our lives comes down to its destructive vs. its non-destructive uses. A holographic bomb sight has already been responsible for quite an impact somewhere in Southeast Asia. Just as an acoustic hologram has contributed to diagnostic medicine.

Holography's future development will be costly, and its traditional sources of funding, which have brought the medium this far, are beginning to dry up. NASA's budget has been cut back, while McDonnell-Douglas has only one or two holographic projects in research at the moment.

But the technology of holography pushes forward, below the surface, in optics labs and on basement sand-tables all across America and in Russia. You will never feel a hologram tapping you on the shoulder, but if you look around sometime soon, you'd better be prepared to touch somebody before you bet he's really there.

Seeking Extraterrestrial Life

(continued from page 26)

England by an amateur anthropologist named Charles Dawson, who was well-respected, who discovered a strange cranium and tooth and jaw which didn't fit together at all well. So a new species of early man was promptly invented, called the Piltdown Man. In the 1950s, radioisotope dating showed that these remains belonged to fairly modern species of monkeys of different types, and had been very carefully doctored. The hoax question is a real problem.

NASA and UFOs

Based on scientific findings over the last 20 or 30 years, we do not believe we have any proof that extraterrestrial intelligence actually exists; it's just a very strong suspicion. It would be very surprising if, in this huge galaxy in which we live, and in the even huger universe, we were alone. It's probable that out of the billions of planets in our galaxy, there are millions like our own Earth. The conditions which allow life to begin must have been present billions of times in the past, and must be present now in many places. That being the case, it's likely that life *has* begun elsewhere; and in at least a fair fraction of cases, since the galaxy has been around for billions of years, some of that life should have evolved, as we did here on this planet, to the stage of intelligence. If that's the case, it's natural to ask: "Is there any way we can detect the existence of other intelligent species in our own galaxy or outside it?"

You have to be thorough. What we usually do at NASA is to go back to Square One and ask some very fundamental questions. During the past two years we have obtained a little funding to ask these fundamental questions and do a feasibility study. In other words: "Is a search for extraterrestrial intelligence in fact feasible?" When you do that, you look first at the underlying scientific arguments. Do they make sense? How solid are they? What sorts of proofs do you have, or not have? What sorts of proofs should you still search out? If you believe the underlying science is reasonable, you examine alternative approaches, and try to decide how you would go about your search. Finally, and this is very important, you ask, "What is the impact of such a search?" And even more important, "What would be the impact of the successful discovery of the existence of another civilization?"

Contact With Extraterrestrial Intelligence

We've found, in these last few years, that everybody gets confused when we talk about contact or communication. For some years, this whole business has been called *CETI*, or *Communication with Extraterrestrial Intelligence*. That was the

name we used when we began. But we found that when we used the word "communication," some people thought that we were already meeting the others across the table, or that it was at least a two-way communication across space. We didn't intend any of this, of course; what we were after was a *search*. Our initial step was an attempt to establish that there was something real in all this. The fundamental question—"Do other civilizations, other intelligent beings, exist out in space?"—that's tough enough. We have to wait until we've answered that one before we even start talking about two-way communication, let alone visiting each other. It's still only a search; it's only one-way.

If a signal were detected, just that fact alone would probably constitute one of the major historical events of our civilization. It would change our whole philosophy and our whole view of ourselves. Just as the pictures the astronauts took brought home to us that we are a small fragile planet in a vast and dangerous universe, in the same way, the simple knowledge that there was somebody out there would make us look anew at ourselves, and might even bind us a little closer together. We are not alone, we are an intelligent species, and there are others! This would motivate people to go on to ask a hundred thousand other questions.

On the other hand, I've also been intrigued by the many doomsayers today: the many people who say we are imperiled, that our own Earth is in great danger because of our own activities, that our species is in danger, and that we will not last very long—fifty years, a hundred years—before some catastrophe overtakes us; because we will not use our heads, and will still behave in an aggressive and emotional fashion.

Benefits of Contact

Any signal that we detected would have to come from a civilization that was millions or even billions of years older than ourselves. It couldn't come from a younger civilization, because they wouldn't have any transmitters. In fact, we're the youngest civilization in the universe. Therefore the ones we heard from would have to be much older; and, therefore, at some point they must have gone through the stage we're going through now. Not identically, of course, but something like it, where they ran into problems of dwindling resources, shortages of food, population problems, disease and war and famine—but here it is, 50 million years later, or two billion years later, and they are still there. That would instantly change our view of things, in that we would then know that it is possible for a civilization which has science and technology to last a very long time. To know about that would be a very fascinating thing—and a very encouraging one.

Chris Foss

Chris Foss is the originator of the "tatty spaceship," his own description of the curiously antique, weatherbeaten machines he paints in vibrating primary colors. And although his lumbering spaceships may not always look capable of traversing galaxies, the young British artist has already traveled a long way on the strength of his patched-up, funky starships.

Since he illustrated his first science fiction book cover almost ten years ago, Chris Foss has become one of the most sought-after cover artists in the British SF publishing industry. *21st Century Foss*, a handsome full-color volume showcasing Foss at his science fiction best, was published last year in Britain by Dragon's Dream and released stateside this year by Big O Publishing.

His unconventional style has attracted the attention of science fiction filmmakers, and since 1975 Foss has done stints on seven films in various contexts, including *Superman*, *Alien* and the legendary but not-yet-filmed *Dune*.

Now he shuttles back and forth between his London studio and a new studio he recently opened in Paris. He appears to have at least a dozen projects going at once—illustrating books, painting covers, designing films, even trying his hand at writing a couple of books.

Nearly everything Chris Foss does is

somehow connected with science fiction, but he still betrays wide-eyed amazement at his stellar success in the science fiction sphere.

"It developed quite by accident," he says of his science fiction work. "It just sort of grew up and grew up, and now it seems to have taken over everything else. I never had a *dramatic* interest in science fiction, but I've always enjoyed inventing things. I think that's how I probably got started... drawing things that obviously couldn't be built or that I could never possess. So I drew them instead, and that was a curious sort of ownership."

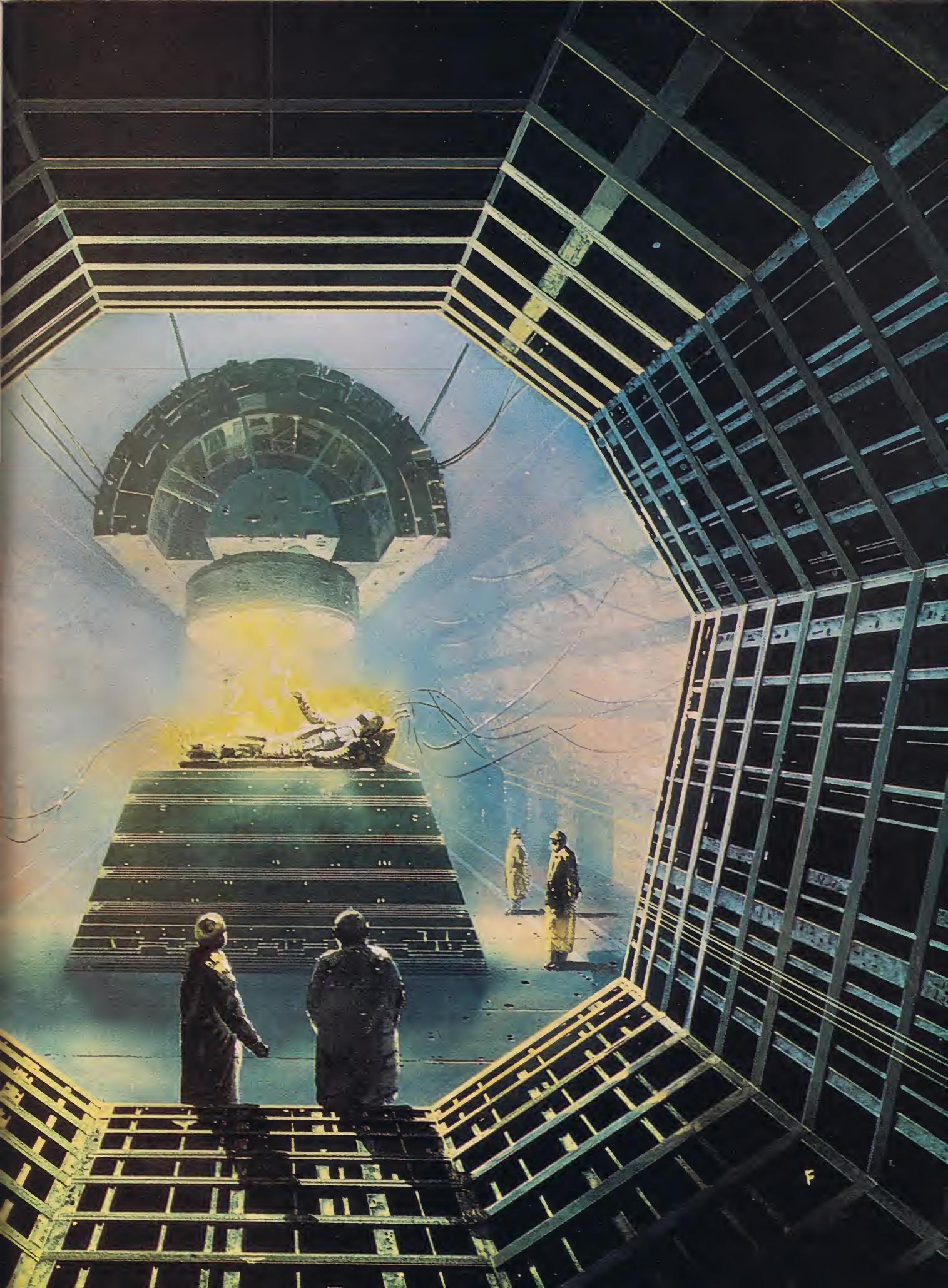
Foss is quite happy with his solidly established reputation as a science fiction artist. "My interest in science fiction is that I think it's a very good vehicle," he says. "It's like a western. The western has always been an extremely good sort of metier for whatever you want to say. I think science fiction is terrific for that. And you can have a bit of fun. You can invent everything."

One current project is a series of paintings and drawings for an illustrated, three-volume version of Isaac Asimov's *Foundation Trilogy*, to be published by Dragon's Dream. Each book will have about 20 color

Right: Foss' cover for a book titled *Recalled to Life*, with electric charges surging through a human body to do the job.

Science fiction success came as a pleasant surprise to this plucky British artist.

By ROBIN SNELSON





An early Foss painting for a British edition of Isaac Asimov's classic *Foundation Trilogy*.

illustrations, plus quite a lot of black-and-white drawings.

Foss has taken his flair for science fiction invention a step further and now he's actually writing stories for a book he will also illustrate. His four short novels, all on SF themes, are to be published in one volume next year by Grenada.

He's also writing and drawing another book, decidedly *not* science fiction, which will be translated into French for publication. "It's totally salacious, kinky and bizarre," Foss laughs, "the kind of book that could only be published in France."

Of course, the subject of sex isn't a new one for the artist. He gained some measure

of fame for his delicately erotic line drawings which illustrated the bestselling books, *The Joy of Sex* and *More Joy of Sex*.

"I suppose I'm what I would call a 'jobbing' illustrator," Foss reflects. "I can paint most things. I do trains and seascapes and that sort of thing. I like to paint women, too, but they're much more difficult and take much longer to do. What happens is that art directors get to know what your favorite things are and whenever they get anything that comes even remotely close, they give it to you. The science fiction has just become a favorite with me."

Unlike many nuts-and-bolts obsessed SF artists, this nonchalant Englishman is hard-

pressed to come up with precise descriptions of the action, settings and scenes in his paintings. "It's very hard to rationalize about these pictures in words," he complains good-naturedly. "I suppose I conceive them visually and it's very hard to transpose a visual conception into a literal, verbal thing."

While he claims that he usually relies on the story to inspire his cover paintings, he admits that art directors often call him with instructions to paint "the usual, you know, a starship with plenty of atmosphere." As a result, his covers sometimes have little to do with the story inside. But Foss shrugs it off, then playfully rallies a mock defense. "It's



all very well expecting poor old artists to read books when they're merely trying to earn a few bob painting pictures." He sighs theatrically. "We're sat down all the time trying to wade through some ghastly script, and needless to say, most of us could do better.

"What I tend to do is get the book open. It's amazing how quickly you can read a book. Within 10 or 15 minutes you've usually found something or other, and you use that something to hang what you're going to do on. Anthologies are the best to do covers for, because then you can do just anything, can't you?"

Ironically, the artist so famous for his

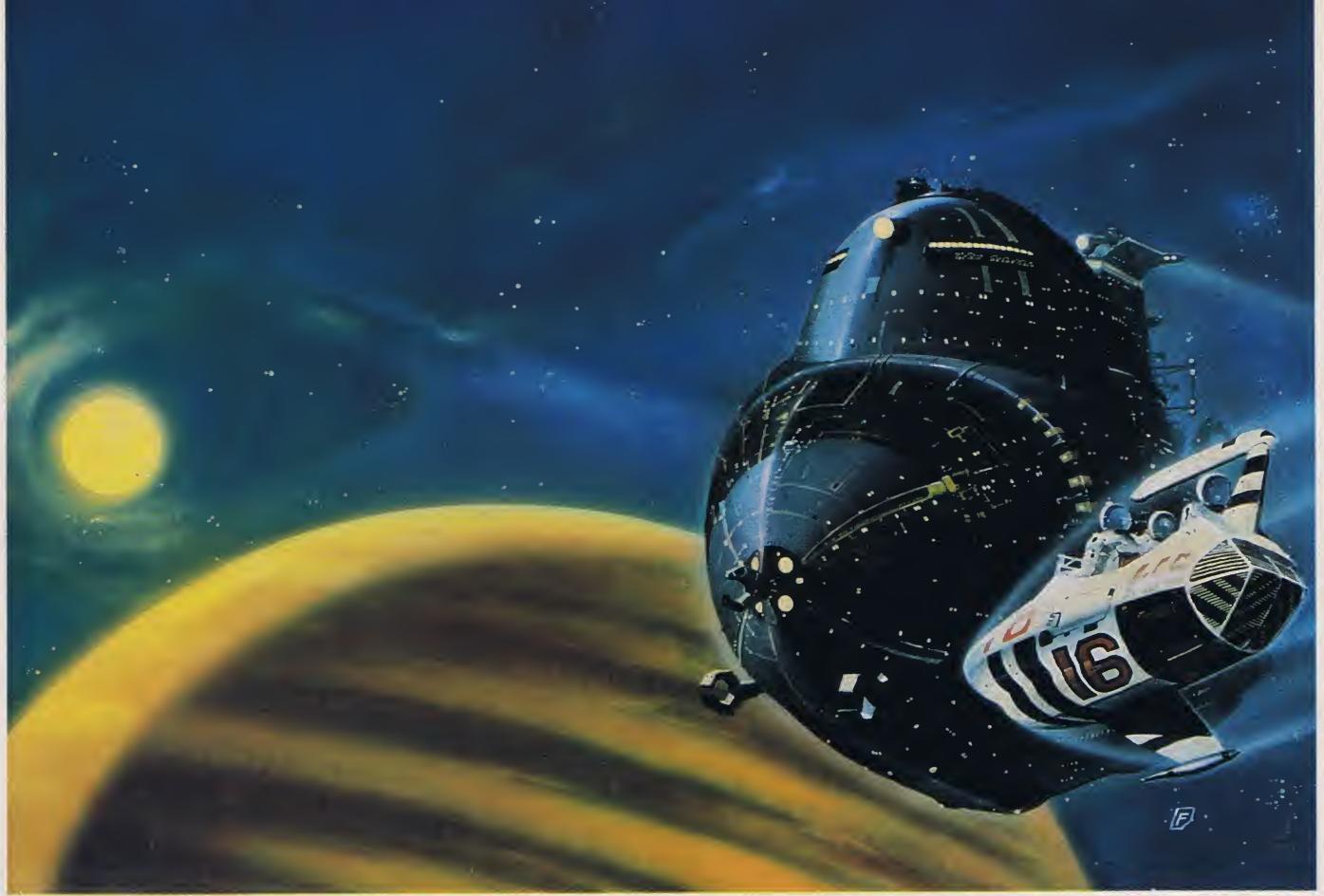
futuristic starships harbors a solid mistrust for machines. "No one is more consistently surprised than I am when planes always stay in the air," he confesses. "I just don't understand why they don't crash."

Perhaps that technophobia contributes something to his penchant for painting somewhat menacing, technically mystifying starships? "They do look rather primitive for futuristic machines, don't they?" he laughs. "It's kind of funny, because you look at modern high-speed technology and it is so well-designed and sleek and smooth . . . which, in a painting, has a rather dated quality, doesn't it? Because that's exactly how 'futuristic' painters did it in the 1930s."

Success spawns imitators, and a good number of new SF artists—particularly British ones—seem to be falling into a stylistic line behind Chris Foss. "It's a source of some frustration," he admits reluctantly. "I wish they'd leave me in peace and go do something different. But it forces me to change, which is not really such a bad thing, to be truthful. I feel I could have got old and gray, quietly knocking little spaceships out into space. But because everyone's doing them, I'm forced to do other things."

In recent years, he's found his talents tapped by the filmmaking industry, affording new avenues of artistic exploration.

When Paris-based director Alejandro



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Jodorowsky began work on his ill-fated production of Frank Herbert's classic, *Dune*, he sought out Foss to do design concepts for the film. Jodorowsky recounts how he discovered Foss' artwork in a gallery and promptly plastered the walls of his studio with reproductions of lurid spaceships and cosmic vistas. In an introduction to *21st Century Foss*, Jodorowsky writes about anticipating his first meeting with Foss:

"What the hell would this mutant be like? Because he had to be a mutant to draw like that! These were not drawings. They were visions! Would he be some neurotic old man? A maniac drug addict? Would one be able to talk to him? Then Chris Foss turned up, completely English in his tap-dancer's shoes, his tight suit as worn by Casanovas in sophisticated dives, with a tooth of quick-gold (I thought it was a diamond), with a yellow shirt of imperial silk, the blinding tie of an aesthetic hit-man, with a child's smile so penetrating he could turn into a hyena. Yes: Chris Foss was a true angel, a being as real and as unreal as his spaceships. A medieval goldsmith of future eons; a being who carried his drawings with the same ultra-maternal care as the Kaitanese Kangaroo-boos carry the children born of their self-insemination."

Jodorowsky continued to be thrilled with Foss and his unreal spaceships, but *Dune* eventually fell through. The money necessary to mount this ambitious science fiction project never materialized. Recently the rights to *Dune* were purchased by Dino DeLaurentiis. Foss and Frank Herbert have met in France to discuss this new turn of events. Hopefully, DeLauréntiis will resurrect Foss' fantastic *Dune* designs when he finally brings the Herbert classic to the screen.

Since his experience with *Dune*, Foss has found himself involved in a continuous string of film projects. First he did initial designs of the planet Krypton for *Superman*, and later he was brought to Los Angeles to do design concepts for this season's SF

smash, *Alien*.

"*Dune* was the best," he says with a touch of wistfulness. "I wish I'd come to it later, because I thought all film work was going to be like that. I was given a totally free hand creatively."

Not so on *Superman*, which Foss says was "a real nine-to-five philosophy." Next he went to Los Angeles to do designs for the spaceships in *Alien*. He was brought to 20th Century-Fox on the recommendation of *Alien* co-writer Dan O'Bannon, whom Foss met when they were both working on *Dune*. In the *Alien* camp, Foss found an atmosphere fraught with politics.

"I was in Los Angeles for about four months, working in washrooms and funny places like that," Foss says wryly. "There were problems. The politics were just unbelievable. I was all creatively hindered. They thought my designs were too far-out and interesting. They thought they'd interfere with the plot," he laughs. "They wanted the spaceship to look more monotonous, like a submarine." In the end, very little if any of Foss' *Alien* concepts made it to the screen.

"I love doing film work," Foss says. "It's great fun and I adore it, but some of the people can be tiresome. The creative people are sweet, but the money people can be an absolute pain. It's sad, because it's potentially very rewarding, but it attracts the worst type of person, the sort of quick-buck merchant who's not totally interested in how good a film it's going to be. The sheer wheeling and dealing and politics can all be rather ghastly."

But his experience so far has only heightened his interest in translating his visions to the screen. Now he's working on his own production.

"I originally started doing my own film because I was so fed up with these politics and awful things involved with filmmaking," Foss says. He was encouraged by the success of *Dark Star*, Dan O'Bannon's first low-budget science fiction epic. "When I think of what Dan O'Bannon managed on *Dark Star* on such a minimal budget, I am

convinced that you can make a perfectly good film on a very low budget. So late last summer, I started my own project and that's sort of taking over at the moment. I've had some very good conversations earlier in the year concerning finance, so it may well come to something."

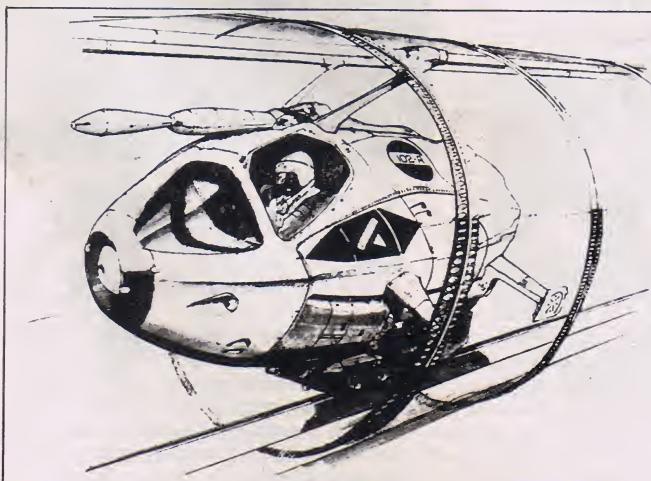
Foss refuses to divulge many details, but says, "It's basically a science fiction film in which we'll use live actors, and one of the main characters is a minotaur."

Another project waiting in the wings is a full-length animated film. "I'm just about to sign a contract with someone in France who's very keen for me to do the overall designs for an animated science fiction film. It's the same company that was trying to do *Dune*." Foss notes with some measure of excitement that his work might translate very well to the animation medium. "It could be quite good fun."

Yet another upcoming project was inspired by his four-month stay in California while working on *Alien*. "I got very keen on the West Coast," he says. "It was my first time in the states and I really did have a marvelous time. I got this idea to do a book loosely based on L.A. I don't want to say too much about it because I think it's such a good idea. It's sort of a socially surrealistic illustrated version of an anglicized view of L.A. I've got a publisher interested."

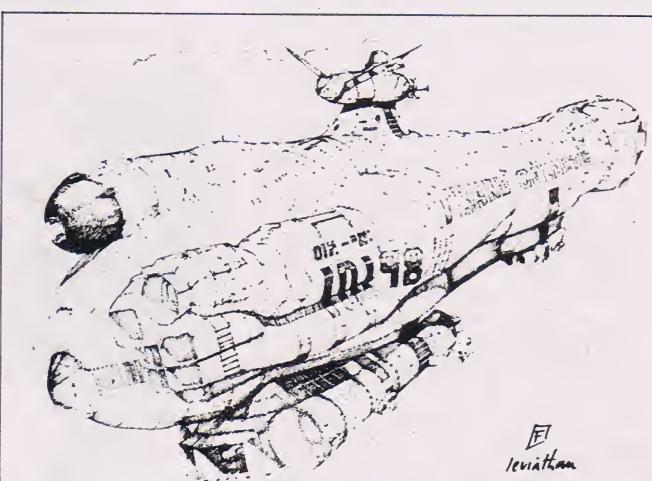
The 33-year-old Englishman seems to have enough projects on the burner to keep him busy for quite a while. Even if one or two fall through, Foss isn't the type to waste any time on regrets. And at any rate, it doesn't sound like he has much time to waste at all. Foss fans whose visual appetites are only whetted by *21st Century Foss* can look forward to seeing much more of the witty outer space artist's work—in upcoming books and future film projects.

Maybe his starships wouldn't actually fly after all, but his futuristic creations have done much to launch Chris Foss' career into a faster-than-light drive toward science fiction success.



Above: Some of Foss' film design sketches. At left, an initial concept for *Superman*, at right an early design for the *Alien* ship (first called *Leviathan*, finally dubbed *Nostromo*). Facing page: Above, Foss' cover painting for the British edition of *Ophiuchi Hotline*; left, one of the artist's favorites, for a book titled *The UFOonauts*, right, cover for a book called *Machine Shaft 10*.

ART © 1978 CHRIS FOSS



(continued from page 47)

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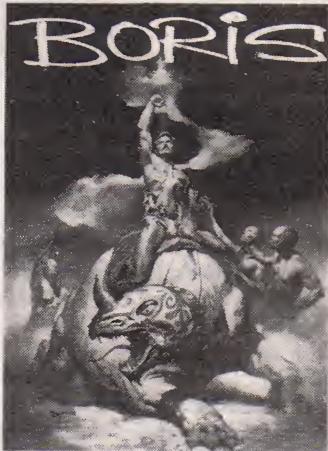
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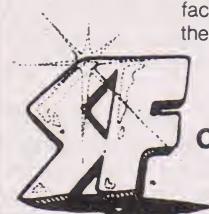
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"Alien" Arrives

(continued from page 32)

area to another. You couldn't get to hypersleep, for instance, by just walking across the sound stage. You had to walk through the entire craft as if it was real. This kind of closed environment, after a while, began to have a weird effect on the actors. They began to almost believe that they were trapped on this strange ship. It rattled them. But that uneasy quality came across on the screen and it looks terrific."

This feeling of claustrophobia delighted director Scott, who beamed to reporters on the set, "I like the idea of impending doom. You know nobody is going to get off, nobody is going to get out of there. That's the way you've got to play it."

Scott's way of playing was effective, albeit nerve-wracking. "After the first crewmember died," Shusett says, "the actors almost lived with terror. The first death is so horrible, so bizarre, they got genuinely frightened. The set was so confined that they found it quite easy to feel that death was around the corner. Yaphet said to me over lunch one day, 'I've seen people die in the war, but I never saw anything as bizarre as this. It's scared me so much that I go around the set in a fright. I go home at night and I don't talk to my wife because I'm so upset.' The shooting lasted for months and, after that first death, they were terrified the entire time.

"They would never know, during the filming, when or how the alien was going to appear. The death scenes weren't spelled out in the script, either. The script would read: 'The monster kills the girl.' We wouldn't say how or in what way. We would spring it on the actors without them knowing where it would come from. It would say in the script that the monster appears. Well, we'd have this air grill suddenly burst apart and the monster's head would appear two inches away from the actor. Of course, the on-camera reaction was spontaneous and incredible."

Shusett admits that this form of filmmaking is fairly unorthodox but, then again, *Alien* is not exactly *The Sound of Music*, plot-wise. "It was sadistic, but effective.

As in all productions, however, *Alien* did have its lighter moments. In between bursts of murder and mayhem, humorous events did occur, although Shusett concedes, "There were so many sickening aspects to this film that even our lighter moments were pretty disgusting.

"One of the most disgustingly funny moments involves me, a bucket of maggots and the alien. The alien's costume itself has an airtight head which is placed above the actor's head inside. It's totally sealed. Whenever we were going to shoot the alien, the crew would bring in a bucket of maggots and stick honey or something in the alien's brain and toss the maggots in there.

"Now, I usually wear a cap around on

the set. One day, I put my cap on a bench and walked off. When I came back, I noticed that, a few feet from the bench, these guys were handling the maggots. Now, I'm not dumb enough to leave my hat near a bunch of maggots. These guys weren't near the bench when I walked away. I grabbed my cap and was about to put it on my head when I suddenly shivered. 'Oh my god. I'd better turn my cap over just in case.' I shook my cap over the bench and five lively maggots fell out. I got hysterical because I have long hair. I ran next door and went bursting into this roomful of Fox executives and pleaded with them to check my hair for maggots. They didn't know what the hell I was talking about, so I had to tell them the whole story. They thought it was hysterical. I was a living legend after that."

Ron Cobb was sensible enough to find his humor wherever and whenever he could. "Imagine how funny it was to see a stagefull of actors and technicians on a multi-million dollar movie, all gathered in silence around a cat. They were all waiting for the film's cat to fall asleep on this seat in the *Nostromo* control room.

"The shot called for Sigourney Weaver to come into the control room and look for the cat. The camera is supposed to pan down and the cat is supposed to be sleeping in the chair. She's supposed to move forward to grab it, accidentally hit a release button and send the seat jumping forward and the cat sprawling off across the room.

"The cat wouldn't fall asleep. All these people are gathered around it, trying to con it into napping. It was an amazing tableau. An entire production paralyzed while someone is trying to sweet-talk a cat into sleeping.

"They shot that scene time after time. The cat wouldn't be there when the camera panned down. Or the cat would jump on Sigourney as soon as she walked in. Or it would lie there and not pay attention to her at all. Then the seat would catapult forward and the cat would disappear into the rafters above the set for good. They'd have to get another cat until someone could find the first one. They had a whole army of cats that looked alike for this shot. You couldn't get the same cat back into that seat after it had been frightened out of its wits. No way. For one entire afternoon, there were cats flying all over the place."

Shusett's inexperience on a movie set also led to a few boffo laugh-getters. On a couple of occasions, while deep in mental reverie, he wandered into camera range. "You'd have these guys in a spaceship out in the middle of nowhere," he chuckles, "and they'd look up and outside the cockpit window would be this guy in a yellow plaid shirt looking in at them. The voice of God would come over the loudspeaker, 'Ron Shusett you are in the shot.' I got better as we went along," he shrugs.

After four months of nail-biting, the live action was finished and work began on approximately four months of miniature

work, inserts and editing. "Once it was over," Veronica Cartwright says, "everyone was back to normal, smiling and saying congratulations and all that. During the actual filming, though, it was grueling. It was very hard to communicate most of the time. I guess you could say a lot of us felt alienated."

The actress allows her thoughts on the matter to trail off in an avalanche of giggles.

A Horrifically Happy Ending

The sound stages are silent.

The sets have been struck.

The cameras are no longer rolling.

Alien is now a finished picture. With nearly eighteen months of woe before and behind the cameras over with, all systems are finally "go" on the science fiction "what dunnit."

Dan O'Bannon's attitude probably best reflects the feelings of all the battle-scarred *Alien* veterans. "Many times during this production, I have wept real tears," he says. "Most of them were wept out of bitter sadness. In recent months, my tears have changed to tears of joy.

"Audiences seeing this movie will experience fear and awe beyond all expectations. There's no philosophy to find in this movie that I care to state. Let the audience find their own. Me? I've always enjoyed a good, scary story. I've always enjoyed the effect of supernatural awe.

"I tried to capture that. I tried to capture it when Ron Cobb first started working on the visuals. And, as the production grew, and I became more and more obsolescent and bigger names and more powerful people were brought up, they attempted to carry on that same idea of supernatural awe. The oddest damn thing is that they succeeded!

"What's up there on the screen is just about what I saw in my head all those years ago. In spite of the arguments, the differences of opinion, despite the many times I gnashed my teeth and tore at my hair, I now look up at the screen and see that the vision is true. That's a major miracle in the movie industry. All the things that went wrong with this movie have turned out to be labor pains, necessary for the birth of something unique. I look up at the screen now and think . . . son of a bitch, *they did it!*"

O'Bannon heaves a sigh and begins an uncharacteristically optimistic monologue. "I wish the public the best of fun when they go to see it. In fact, I have a statement for the American public: *I dare you to go see it*. All you people out there who grumble and groan about spending four dollars to see a movie that turns out to be exactly like one you've already seen . . . I dare you to plunk down your money and go see this film. And," he adds with a sly chuckle, "I dare you to stay in your seats until the very end. See if you can take it."

O'Bannon's chuckling grows stronger until the writer/creator of *Alien* is caught up in a burst of unbridled laughter.

It is a maniacal type of laughter decidedly not of this Earth.

The Third World: Space Powers of 2005?

Ask a dozen of your friends who will be the dominant space powers in the year 2005. Most will tell you the U.S.A. will be at the vanguard. Others consider the Soviets' present-day success with the Salyut space station and predict a massive Russian presence. Some few will make a case for the Western Europeans or the Japanese. But almost everybody will agree on one thing: One or more of the great industrial nations will forge the complex of space factories, Moon and asteroid mines and huge space habitats that will usher in the Third Millennium. Right? Wrong!

Here's my prediction: The Third World will take the lead. But—those banana republics just graduated from being colonies themselves! you may scoff. They're poor and uneducated, with chickens and pigs running in the streets!

Look at it this way. What's important is what *doesn't* run in their streets. They don't have millions of hand-wringing liberals, paranoid conservatives and flaky pseudo-environmentalists who wouldn't know an ecosystem if it ate them for breakfast.

Of course, Liberia, Sri Lanka, Brazil, Chile, the People's Republic of China, Indonesia and other developing countries don't have great universities, cadres of scientists or giant industrial facilities. But guts, vision and the absence of developed world liabilities count for a lot more!

Why does the West African country of Zaire host the private OTRAG rocket base? Why is *Fuerza Aerea*, the magazine of the Chilean Air Force, carrying a series on space colonization? Mainland China still runs her railroads on coal, but has already launched several satellites. And a number of equatorial nations are negotiating with the California-based Earthport Project to establish a 200-square-mile free trade zone which will support a major spaceport.

The Third World is looking toward more than space. It is reaching for all sorts of high technology. And because the developing countries don't face the problem of dismantling a massive 19th century vintage industrial network of telephone lines and smokestacks, they may zoom into the 21st century faster than the developed world.

"Appropriate technology" fans will tell you that the people of the world who live in equatorial climes and happen to have darker skins are panting after bicycle-powered coffee grinders, cars that run on fermented chicken droppings and other



trappings of the "Small is Beautiful" mentality. Yes, they'll tell you the people of the Third World live in harmony with nature, and only desire a little Western ingenuity to tell them how to design the perfect solar hot dog—oh, excuse me—brown rice cooker.

Well, before we start planning a nice appropriate future for the Third World, maybe we'd better listen to what some of them have in mind for themselves.

Assibi O. Abudu of the Economic Council of Ghana would like a few asteroid mines, space colonies and solar power satellites, thank you. How about an Environmental Protection Agency? "You Westerners got to make lots of pollution when you industrialized," Abudu says. "And now the imperialists want to keep us from doing it!"

Listen to Guido Pincheira Vega, who directs Chile's energy program. One starry night on the bank of a bayou he told me, "We need solar power satellites to power our northern region." Today Chile ships her copper ore to foreigners because there are no fossil fuels or hydroelectric power sources in the arid north where her rich mineral resources lie. With a solar power satellite, Chile can build smelters, refineries, and the myriad of industries that need abundant energy. Chile could prosper.

Right now a lot of interest is being generated in the equatorial Third World about a concept called Earthport. Several nations are negotiating to set aside a

200-square-mile, tax-free, regulation-free trade zone which will become the heart of a giant international spaceport.

Hop into the time machine with me to see why nations such as Liberia and Indonesia are so interested in Earthport.

We step out under the blazing Sun of 2005 AD. To the left is the seaport, with hundreds of freighters unloading passengers and goods. Far off to the right we see the gleam of gantries and hear the roar of a giant passenger liner as it rides a pillar of fire into the sky. On the edge of the horizon, bright objects flash noiselessly upward, one after another, lofted on the tips of laser beams. Those are the freighters, shipping goods to space cheaper than the U.S. Post Awful ships first class mail. You hear a distant boom, boom, boom...not the beating of native drums, but the sonic booms of reentering freighters.

And before you spreads the megalopolis of Earthport—the richest city in the solar system. Her fabled streets teem with people babbling hundreds of Earth-tongues. Everywhere you go you meet proud spacefolk: Belters from beyond Mars, Lunans, Lagrangians and more. Street vendors hawk souvenir asteroid nuggets and fragrant mangoes. Shops overflow with duty-free goods: jewels from the laboratories of Leo (low Earth orbit), Martian surface-rated camping gear, cheap pocket tridee sets, and more. There's a recruiting district where thousands of companies hire more than a million people every year to work in space factories. The sign over the Galactic Enterprises Office proclaims "Earn your own home in ten years!"

We hop back to 1979 and you ask, "Great—you mean us Americans can't get in on this action?" But you can. As a private citizen you can get in on the ground floor of the Earthport Project. You can help with your time as a volunteer worker or with your tax-deductible donations. Donations of more than \$15 will get you an information package about Earthport. Write to Mark Frazier at Earthport, 221 W. Carrillo St., Santa Barbara, CA 93101.

And in 2005 you can tell your children—or grandchildren—that you helped lay the foundations of the greatest city in the solar system: Earthport.

Carolyn Henson is a founder and President of the L-5 Society, a non-profit organization dedicated to making space colonies a reality in our lifetime.



PHOTO: RICHARD TODD

By LARRY NIVEN

Author Larry Niven is a mathematician turned science fiction specialist, who claims that he became a writer, "because I ran out of options." The Hugo and Nebula Award winner is best known for such books as *World of Ptavvs*, *A Gift From Earth*, *Neutron Star*, *All the Myriad Ways*, *Ringworld*, *The Shape of Space*, *A Hole in Space*, *The Protector* and *Tales of Known Space*. With Colleague Jerry Pournelle he has penned best-sellers *Lucifer's Hammer* and *The Mote in God's Eye*. As can be seen from this article, Niven is a strong advocate of the space program, and admits that he became involved with science as a result of his enthusiasm for science fiction. He now lives in Tarzana, California.

Staying Rich

The world's resources are running out. You've heard it before, and it may be true.

The civilizations of Earth's past were all based on what we consider easy resources: deposits of coal and metals near the surface, forests waiting to be cut down, territories that seemed *too big* to be ruined by puny human efforts. They weren't, of course. The Sahara was a forest. Man turned it into a desert.

Our efforts at pollution are no longer puny. The easy metal ores have been dug up. The easy oil is almost gone, and we're paying fifty billion a year to the Arabs for the last of it. The refined metals haven't disappeared, of course; but recycling old automobile junkyards would take enormous power, and we don't have that power. We know where that power is—I'll show you—but we don't have it in our grasp as yet.

If civilization collapsed today—through an atomic war, or a major meteor strike, or just running out of the fuels that keep it going—it may be that no future civilization could be built on our bones. But that isn't necessarily so. None of these disasters would destroy *all* knowledge. We would still know how to make aluminum, for instance. We would remember how to rotate crops, and why. It's possible we could fight our way back.

But can we fight our way up from *here*?

* * *

The world has never seen such wealth as it has today.

As a result, many of us are spoiled.

We expect to live into our sixties, and to keep most of our teeth, one way or another.

We expect starvation to be rare. If a body were found dead of starvation in any city street, it would make news clear across the country. In past ages those bodies were every city's continual health problem.

The taxes you pay are enormous. Me too.

I don't much like giving half of what I make to the government. If any government had tried that in any previous era, the tax collectors would have had their heads mounted on poles. Why isn't it happening today? Because even after April 15th, most of us still have something left to protect. We are not beggared by these huge taxes.

And the benefits we receive are enormous too. They would have been luxuries beyond our grasp, or wild daydreams, in any age but this.

The curbs of certain city streets recently sprouted ramps for wheelchairs. No big deal was made of it. It just happened: concrete was broken up and re-poured, there was minor annoyance, you had to walk around the barriers for awhile . . . and now people in wheelchairs can use the sidewalks just like everybody else. It's wonderful, but it must have been expensive.

Your freeways are expensive. Lighting streets at night, all night, *that's* expensive. Universal schooling is expensive. Integration is hideously expensive; get on the freeway at 3:10 p.m. and count the yellow school busses.

In communications and organization and manpower, can you imagine what it *costs* to offer every citizen in the United States the right to vote? Tyranny goes with poverty; it's cheaper than democracy. There is only one nation in the entire continent of Africa that offers its citizens the vote. Can you name it?

There are expenses we probably can't afford, but we pay for them anyway. Consider the cost of convicting Sirhan Sirhan, which was three million dollars, despite his being found literally with a smoking gun in his hand. We can't keep that up forever. No previous civilization would have tried.

Welfare is more expensive than you think. (I'm ignoring design problems and fraud.) If you pay someone not to work, you must pay him more to work. Any com-



ART: DENISE WATT/GEIGER COURTESY NASA

petent economist can tell you that we're sabotaging the value of the dollar and giving a terrific advantage to foreign imports. Can we afford that?

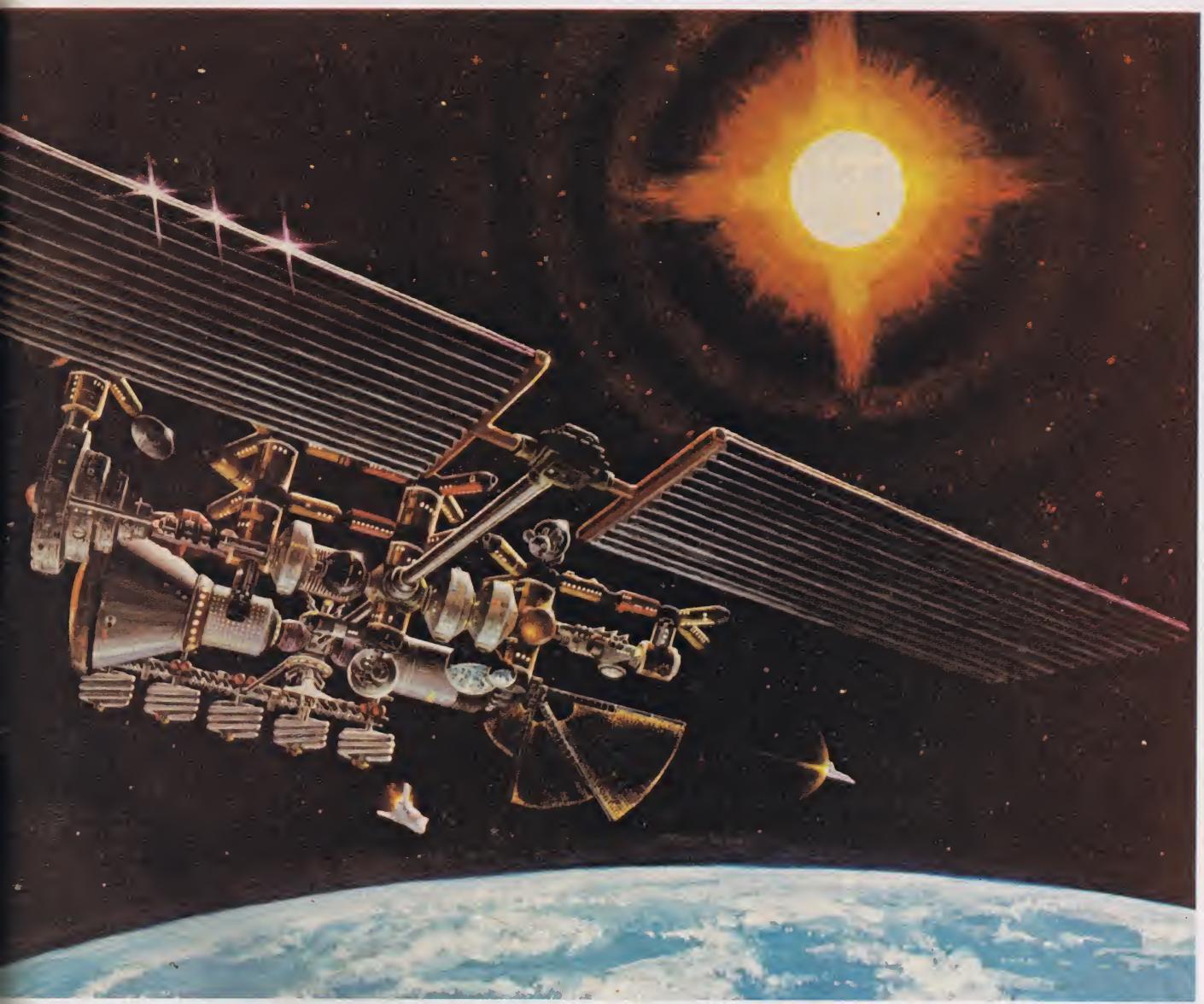
Maybe we can, and maybe it's worth it. If you're ruined in business today (which is likely enough; the government paperwork alone is enough to strangle a small business) you don't *have* to dive out a window. You can survive. The budding artist or novelist can stay on Welfare until he makes it . . . or doesn't. There's less desperation going around than there was in the Great Depression.

* * *

There's no denying it.

We are rich.

There are many very wealthy nations and we are all vulnerable. Guilt threatens us. The poor outnumber us, in India, South America, Africa. Thanks to modern com-



A fantastic conception of a multi-purpose industrial/habitat facility in Earth orbit, producing energy and new products in space.

munications, and for the first time in history, they are fully aware of what they're missing.

But if we shared our wealth equally, head for head, the whole world would be poor.

We'd rather make the whole world rich.

Throughout human history that has not been possible even in conception.

But today, the wealth needed exists. It's right over your head.

What does a civilization call *wealth*? Three things: metals, power, and a place to pollute. The people who settled North America found all three, and they counted themselves wealthy.

Maybe we don't need all three. With enough power we can recycle old automobiles. With enough power we could even deal with pollution . . . but that can become a vicious circle. Most forms of

power generate pollution.

And so does solar power, of course.

We live 92,900,000 miles from an unsupervised and erratic fusion reactor of prodigious size. These things have been known to explode. Even when they're working right, they put out all kinds of deadly radiation. Our own Sun is a 4% variable star . . . which may have stopped working. Cosmologists have been going mildly crazy wondering why the Sun isn't generating neutrinos. Neutrinos should be a byproduct of the way a sun is supposed to work.

We wouldn't normally choose to live that close to a variable star. But it's there; we may as well use it.

I am *not* advocating spreading glittering solar power collectors across a perfectly good desert. For one thing, they're ugly.

For another, we don't get enough sunlight to make it worthwhile. We get one kilowatt per square meter, in naked space, at the Earth's orbit, and Earth's atmosphere eats a hefty percentage of that.

* * *

It's better to work in orbit.

Building solar collectors there is easy. They don't have to stand up to gravity. They can be miles across, and as flimsy as the Echo satellites were.

There are several routes to travel here. One suggestion is to convert the raw sunlight of space to microwaves and beam them down. To turn the microwaves back to electricity you do need a patch of land. But the land hasn't been made useless; you can grow grass and graze cattle under the collector grids.

(continued on page 70)

Another suggestion is to put up mirrors. Lots of mirrors several square miles across, falling in rows across the sky. Ordinarily they would beam their light down to several square miles of solar collectors, to be converted directly to electricity. (Again we're making a patch of desert unsightly, but it's only a *little* patch.) In emergencies we could turn the mirrors and divert some light, in order to prevent a frost by warming up some orange groves, or break up a hurricane by putting a warm current in the right place, or light up a wilderness so a child can be found, or . . . you name it, even light up New Orleans for a Mardi Gras!

Either of these systems can be set up so that they only interrupt sunlight that was already on its way to Earth. That way we can avoid raising the Earth's heat balance.

But maybe we want the mirrors or collectors in larger orbits, interrupting sunlight that was on its way to interstellar space. There's evidence that the fifth Ice Age started a couple of hundred years ago. Have we been holding off the glaciers solely by burning fossil fuels? With solar power from space we could hold them off a little longer.

And we'd have the clean power we need to run electric automobiles; to recycle the metal in our old dirty internal combustion cars; to shut down the coal mines, and end the long history of death by black-lung disease, and clean up our act a little.

I've been speaking of wealth in terms of power, metal, and a place to pollute.

Now you know where the power is. Well, the metal is up there too. In 1977 the United States processed metal ores equivalent to a sphere a little over three kilometers in diameter. There are 40,000 or more asteroids larger than five kilometers in diameter, and many of them will run 50% metal ores!

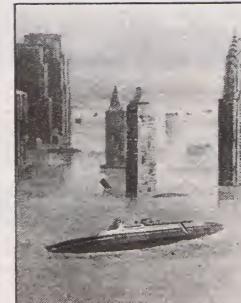
What about pollution? Not to worry. You could vaporize the Earth without noticeably polluting space.

There is yet another resource in space, not normally considered to be wealth. I refer to free fall. Free fall allows incredibly flimsy construction: cheap once the materials have been lifted. Free fall allows the manufacture of alloys impossible on Earth: the molten components separate in a gravity field. Free fall allows the growth of single-crystal whiskers centimeters long; and those, aligned and embedded in a matrix, would allow building materials stronger than any we can make now. Factories in orbit would create entire new industries . . .

But forget that for a moment. Just consider old industries moved to space. The power to do it would come from power stations in orbit. Pollution could be ignored entirely. We could turn the Earth into a park.

It wouldn't happen all at once. But I believe it could be done . . . and soon. □

next issue



MOONRAKER

This summer, Her Majesty's most intrepid secret agent, James Bond will take to space in the most spectacular 007 adventure ever, *Moonraker*. **FUTURE LIFE** takes an exclusive guided tour of the spacey world of James Bond; replete with high flying shuttles, orbiting space stations, lethal lasers and computer-guided villains intent on conquering the world. Bond, of course, is quite at home among such adverse elements. On this filmed outing, it seems, he had NASA's official backing.

TOFFLER ON FUTURE LEARNING

In 1970, Alvin Toffler shook up quite a few people with his prophetic book, *Future Shock*. Next issue, Toffler turns his attention to the future of education. Why aren't schools functioning today? Can anything be done to save them? What will the classroom of the future look like? How courses, students and modes of learning will change as the world spins ever-onward into an unknown tomorrow.

FIRST MEN ON THE MOON

On July 20th, 1969, science fiction became science fact. Neil Armstrong stepped down from the *Apollo 11* spacecraft and placed his foot firmly in the soil of the Moon. Ten years after this historic event, **FUTURE LIFE** recalls some of the phenomenal teamwork that went on behind-the-scenes in this seemingly impossible task. A triumph of both technology and human willpower.

ICE AGE OR HEAT DEATH

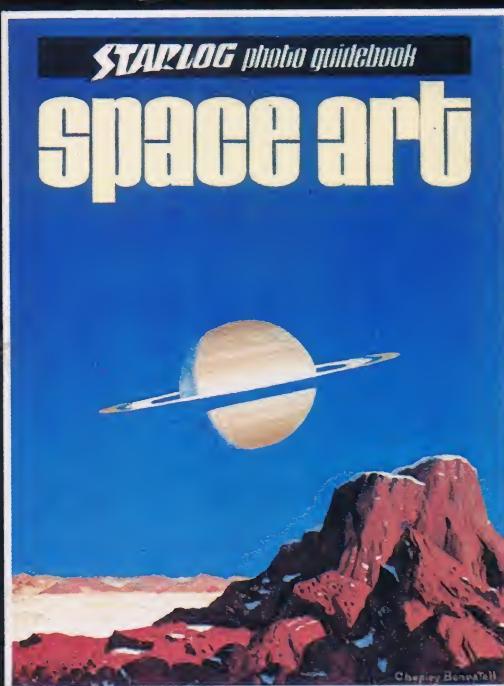
Deadly greenhouse or glacier palace . . . is this to be the fate of planet Earth? There are scientific arguments to support both sides of the futuristic climatic coin and **FUTURE LIFE** takes a look at both. Will a rise in the Earth's temperature cause a melting of the polar icecaps, causing global flooding? Or will a new Ice Age slowly creep over civilization? Is there any way to combat these climate calamities-in-the-making? Both the U.S. and the U.S.S.R. have come up with some possible solutions.

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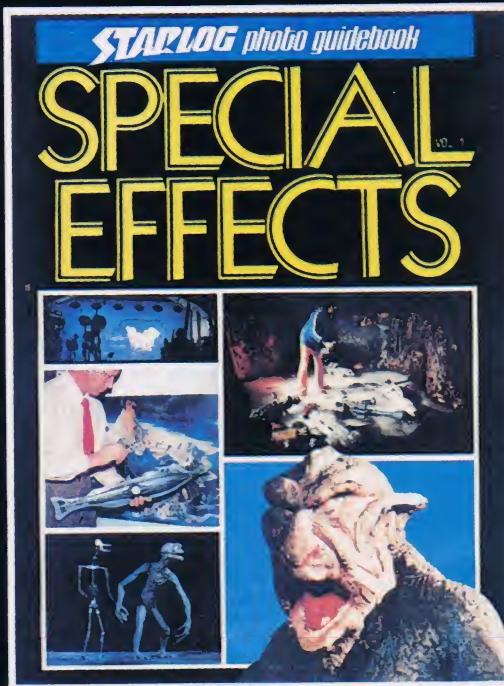
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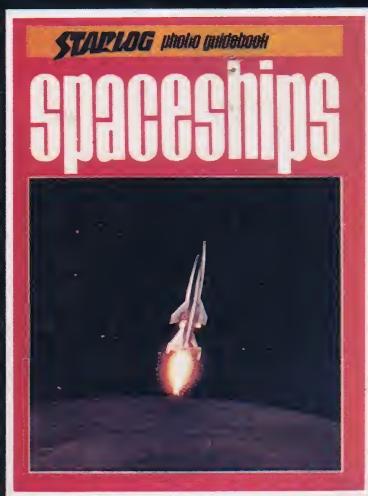


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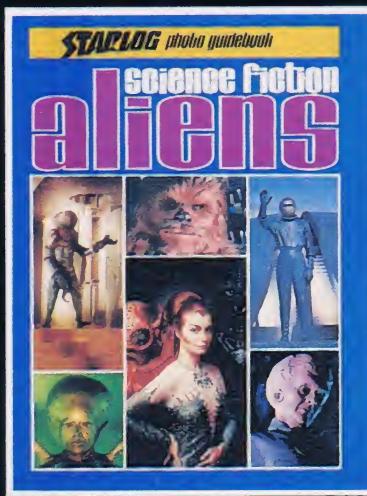
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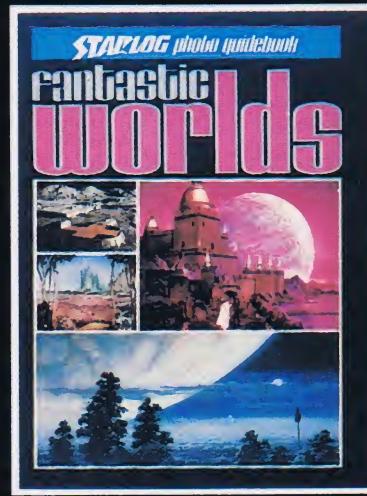
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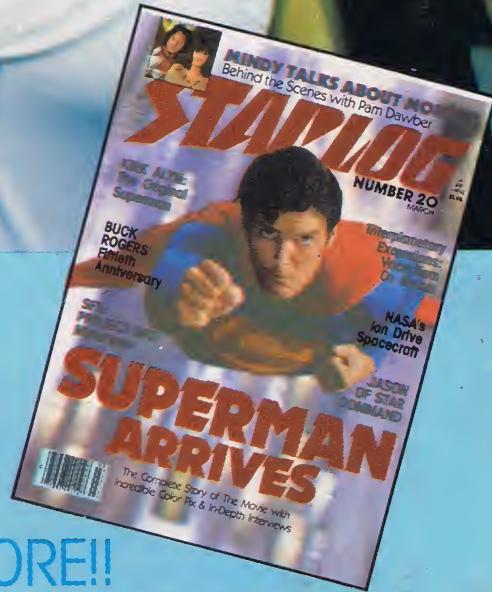
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